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ABSTRACT

This volume is the third in a series of learning activities designed to supplement a K-12 curriculum. The activities are interdisciplinary in nature and include topics in science, mathematics, social studies, language arts, and fine arts. Besides a division of activities according to grade and subject matter, they are also grouped by environmental concepts that include the biophysical, sociocultural, management, and change; and by problem areas that concern aesthetics, health, genetics, eco-community relationships, and psychological and behavioral considerations. Each activity includes a reference to the environmental education program from from which it was taken, as well as a stated purpose and a methods section. (BA)

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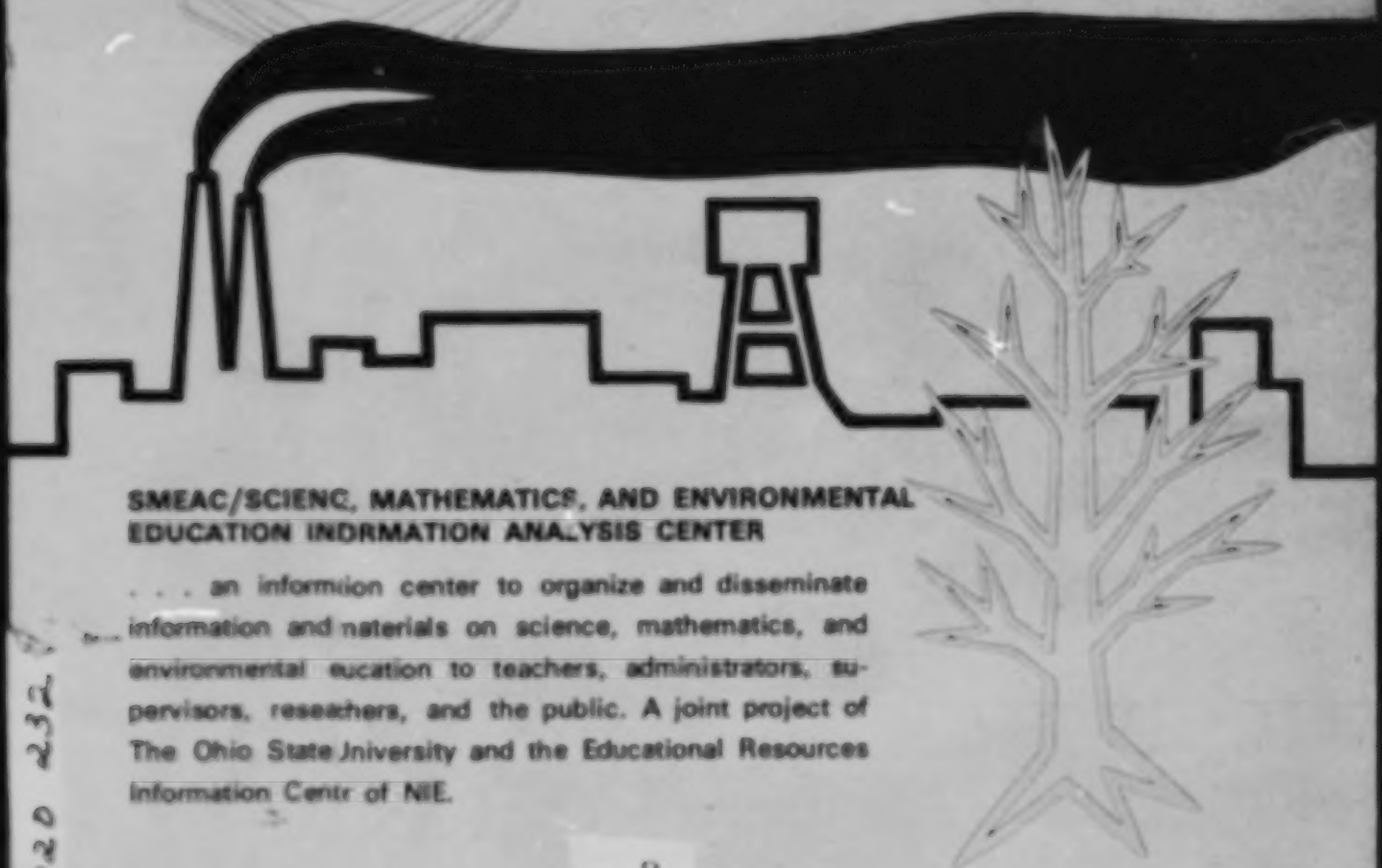
Teaching Activities In Environmental Education

Volume III—1975

by
John H. Wheatley
and
Herbert L. Coon



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TEACHING ACTIVITIES IN ENVIRONMENTAL EDUCATION

Volume III - 1975

Selected and edited by

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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for this series are invited.

John F. Disinger
Associate Director
Environmental Education

Sponsored by the Educational Resources Information Center of the National Institute of Education and The Ohio State University.

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Preface

We have been pleased by the extent of teacher interest in Volume I and Volume II of this series of Teaching Activities in Environmental Education. Obviously, many teachers are looking for simple short-term activities in environmental education. They are looking for activities that can be integrated easily into the regular on-going school program of studies. It is our view that use of activities such as those presented in this volume and its predecessors is a first easy step that may be taken by a teacher to give greater attention to environmental questions.

Users of these materials possibly should be reminded of the obvious; useful as such ideas may be they do not constitute a program in environmental education. Programs, in our view, should involve school system personnel in working together to define the total content to be offered (scope) and the location of various segments of this content in the K-12 years (sequence).

In all three volumes of this series we cite school systems and other groups who have developed environmental education materials and/or programs. Readers who are interested in broad programs rather than specific activities can use the ERIC (Educational Resources Information Center) system to identify school systems or other organizations that have developed such programs. In most cases the program descriptions and materials developed for implementing the programs are available in their entirety in ERIC.

Teachers using this volume will find activities suggested as appropriate for four levels: K3, 4-6, 7-9, 10-12. Activities deemed appropriate for more than one level are included more than once. Teachers are urged to make modifications in vocabulary, use of equipment, length of time spent on an activity and so forth whenever, in their judgment, such modifications are desirable. Teachers are also urged to develop environmental education activities based on personal experiences and reading. American life is full of situations and points of view concerning the environment which can be studied profitably in schools. The problem area classification modified from Brubaker indicates the breadth of concerns that comprise environmental education. The concepts in environmental education from Bowman identify some understandings that all school children should acquire. For each activity we have identified a concept and problem area related to the activity but often the activity can easily broaden beyond a single concept or problem.

We have also suggested that activities are primarily in science, social studies, or other conventional subject matter fields. In some cases, we have suggested combinations such as science-mathematics, social studies-science and so forth. But our study of materials which comprise the ERIC collection in environmental education and our editing of activities included in this and earlier publications emphasize the interdisciplinary nature of most environmental questions. Most experiences in daily living are interdisciplinary. Most experiences in daily living deal with uncertainties, with conflicting values, with "trade-offs," with questions about the place of self in society. Possibly the growing interest in environmental education is related to the fact that it deals with the reality of life as it is found outside classroom walls.

John H. Wheatley
Herbert L. Coon

CONCEPTS IN ENVIRONMENTAL EDUCATION

from Bowman, Mary Lynne Cox. The Development and Field Validation of an Instrument to Assess College Students' Attitudes Toward the Determinants of Environmental Issues. Unpublished doctoral dissertation, The Ohio State University, Columbus, Ohio, 1972.

I. BIO-PHYSICAL
   1. Living things are interdependent with one another and their environment.
   2. Green plants are the ultimate sources of food, clothing, shelter, and energy in most societies.
   3. An organism is the product of its heredity and environment.
   4. In any environment, one component--like space, water, air, or food--may become a limiting factor.
   5. The natural environment is irreplaceable.

II. SOCIO-CULTURAL
   1. The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and lifeways that are transmitted to its progeny.
   2. The relationships between man and the natural environment are mediated by his culture.
   3. Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

III. MANAGEMENT
   1. The management of natural resources to meet the needs of successive generations demands long-range planning.
   2. Family planning and the limiting of family also are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.
   3. Environmental management involves the application of knowledge from many different disciplines.
   4. Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

IV. CHANGE
   1. Organisms and environments are in constant change.
   2. The rate of change in an environment may exceed the rate of organism adaptation.
   3. All living things, including man, are continually evolving.
   4. Man has been a factor affecting plant and animal succession and environmental processes.
   5. Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM AREA CLASSIFICATION

modified from Brubaker, Sterling. To Live on Earth. Baltimore: The Johns Hopkins Press, 1972.

I. AESTHETIC CONSIDERATIONS
1. odor
2. air particulate matter - visibility, irritation
3. visual pollution - signs, power lines, billboards, buildings
4. litter
5. noise
6. water quality - taste, odor
7. open spaces - urban and rural
8. city planning and convenience
9. traffic control
10. cultural opportunity
11. recreational facilities

II. HEALTH CONSIDERATIONS
1. disease control - breeding ground control
2. radioactivity
3. air quality - harmful effects (pathogens, chemicals)
4. water quality - harmful effects (pathogens, chemicals)
5. food quality - pesticides, additives
6. medical treatment

III. GENETIC CONSIDERATIONS
1. radioactivity
2. chemicals - air, water, food
3. medical treatment

IV. ECO-COMMUNITY RELATIONSHIPS
1. ecological considerations
2. land use
3. natural resource use
4. energy production
5. urban planning
6. population studies
7. species control (non-human)
8. weather
9. fertilizers and pesticides
10. effects of air quality on ecosystem
11. effects of water quality on ecosystem
12. effects of humans on ecosystems

V. PSYCHOLOGICAL AND BEHAVIORAL CONSIDERATIONS
1. crowding
2. social aspects
3. cultural considerations

BREAKDOWN OF ACTIVITIES BY CATEGORY

(Some activities fall into more than one category in each area.)

	Category	Number of Activities
Grade Level:	K - 3	14
	4 - 6	45
	7 - 9	58
	10 - 12	37
Subject Area:	Science	63
	Mathematics	8
	Social Studies	80
	Language Arts	20
	Fine Arts	14
Concepts:	Bio-physical	16
	Socio-cultural	25
	Management	28
	Change	33
Problem Area:	Aesthetics	20
	Health	5
	Genetics	3
	Eco-Community Relationships	57
	Psychological/Behavioral	18

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	Activities	Page
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Science	4	1
Science-Social Studies	3	
Language Arts	4	
Fine Arts	2	
Fine Arts-Social Studies	1	
Grade Level 4-6		
Science	13	16
Science-Social Studies	3	
Science-Mathematics	1	
Science-Fine Arts	1	
Science-Language Arts	1	
Mathematics-Science	1	
Social Studies	12	
Social Studies-Science	2	
Social Studies-Home Economics	1	
Language Arts	4	
Language Arts-Social Studies	2	
Fine Arts	2	
Fine Arts-Social Studies	1	
Fine Arts-Language Arts	1	
Grade Level 7-9		
Science	13	68
Science-Mathematics	1	
Science-Social Studies	4	
Science-Language Arts	1	
Mathematics	2	
Mathematics-Science	1	
Mathematics-Social Studies	1	
Social Studies	23	
Social Studies-Science	3	
Social Studies-Language Arts	1	
Social Studies-Home Economics	1	
Language Arts	2	
Language Arts-Social Studies	1	
Fine Arts	3	
Fine Arts-Language Arts	1	
Grade Level 10-12		
Science	7	136
Science-Social Studies	3	
Mathematics	1	
Social Studies	20	
Social Studies-Science	1	
Physical Education	1	
Language Arts	2	
Fine Arts	2	

GRADE LEVEL K-3

Activities

Science	4
Science-Social Studies	3
Language Arts	4
Fine Arts	2
Fine Arts-Social Studies	1

PURPOSE: To dramatize simply the power of sunlight.

LEVEL: K-3

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Energy, Key to the Future - Teaching Techniques for the Understanding and Conservation of Energy K-12. Dutchess County Board of Cooperative Educational Services, RD #1 Salt Point Turnpike, Poughkeepsie, New York 12601.

ACTIVITY: Obtain two clear soft-drink bottles. Tie tightly equal size empty balloons over the opening of each bottle. Place one bottle on the window ledge in bright sunlight and place the other in a shaded place in the room. Note what happens to each balloon during the next hour. Discuss reasons for the difference. What is the energy source. Did the sun do "work" when it expanded the balloon? Can we use the sun to help heat our homes? How?

PURPOSE: To understand some differences found in soils.

LEVEL: K-3

SUBJECT: Science

CONCEPT: I-1 Livings things are interdependent with one another and their environment.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: "Mini-Lessons on Environmental Awareness," Union County Schools, Lake Butler, Florida.

ACTIVITY: Discuss with the class what will be needed to grow some flowers or other plants in their classroom. When soil is mentioned raise the question as to whether some soils may be better than others in holding water for the plants to use. On a walking trip around the school yard get samples of soil that are different (humus, clay, sandy, etc.). Place each sample in a labeled glass jar that can be sealed. Put the jar in a warm place and observe at intervals for water condensation on the inside of the jar. Where did this come from?

Place equal amounts of the different soils in milk cartons that have holes punched in the bottoms and have a paper napkin or other substance on the bottom to prevent soil leaking out. Use a pan or other container to catch the water that runs through. Pour 1 cup of water into each carton. Does any run through? Continue until the different soils are completely saturated with water. Which type held the most? How much more? Which type will have the most water available for plants to use?

Plant similar flowers, bulbs, or seeds in each type of soil and treat identically during a growing period. Involve the children in keeping track of the growth process and deciding what type of soil is best.

PURPOSE: To identify some of the causes of erosion.

LEVEL: K-3
4-6

SUBJECT: Science

CONCEPT: IV-1 Organisms and environment are in constant change.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: A View of the Environment - Outdoor Classroom, Camping, and Recreation. Conservation Curriculum Improvement Project, South Carolina State Department of Education, Columbia.

ACTIVITY: Take the students on a field trip to view some places where erosion has occurred. A ditch or gully on the school site would be a good place to start. If possible, compare these sites with sloping areas that are covered with vegetation and do not show signs of erosion. Elicit from the students what characteristics of the land may have allowed erosion in the first instance but not in the second instance. The students should mention slope, lack of cover, and particulate nature of the soil. Examine eroded soil for the presence of animal life. If possible visit the eroding sites during or immediately after a rain storm. Measure the eroding sites and determine if they are getting larger as erosion continues.

Adopt an erosion site. Decide what steps to take to prevent the continuation of erosion, and follow this procedure on your site. Try various methods at different sites--for example, planting grass, diverting the water flow, stair-stepping (terracing) the site, and using leaf litter to slow the water flow over the site.

PURPOSE: To show one cause of erosion and rock break-up.

LEVEL: K-3
4-6

SUBJECT: Science

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: A View of the Environment - Outdoor Classroom, Camping, and Recreation. Conservation Curriculum Improvement Project, South Carolina State Department of Education, Columbia.

ACTIVITY: The effect of alternate freezing and thawing on rock surfaces can be easily demonstrated in class or by the students at home. Fill a plastic container full of water, and place it in a freezer. As the water freezes and forms crystals, the resulting ice block will occupy more space than the original water; the expansion of the ice will crack the plastic container demonstrating the force of the expansion. If a small container is used, the water will freeze faster.

After demonstrating the force of expanding ice, use the same procedure to show the effects of the force in breaking up rocks. Obtain several types of rocks--some porous ones should be used. Soak the rocks in a water bath for a short period of time (for the porous rocks it is important that sufficient time be allowed for the water to penetrate throughout the rock). Place each rock in a separate plastic bag, and put each in a freezer overnight. The next day remove the rocks, allow to thaw, and observe the presence of rock debris broken off by the freezing-thawing process. Soak the rocks again and repeat the freezing-thawing steps.

Stress the point that in nature this freezing-thawing process occurs over many years and slowly breaks down the rock into soil particles. In the field observe soil and rock particles of various sizes; each is being acted on further by the expansion force of ice.

PURPOSE: To observe evidence of "unclean" air.

LEVEL. K-3

SUBJECT: Science
Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I-2 Aesthetic Considerations - air particulate matter

REFERENCE: Environmental Education Guide - Grade One. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: There are several ways in which students can see that the air air around us is not clean. Try several of the activities listed below:

1. Bring in a plant that is shedding its pollen into the air; a pine branch would be very effective. How does pollen affect some people? What happens to the pollen after it falls from the plants?

2. Hold a piece of glass or metal over a burning candle, and observe the carbon deposit which collects. Why don't we usually see the soot in the air? Where does burning take place in the home, in the city? What happens to the soot in the air?

3. Dust the top of a table in the morning and place a book on the clean surface; at the end of the day remove the book and compare the protected surface (clean) with the surrounding surface. Replace the book in the same spot and check it again after two days. Where does dust come from? What is it made of? How does dust get into the air?

4. Hang a piece of clean cheesecloth in a tree; after several days observe the things that have been caught in the cheesecloth. Compare the color of the cheesecloth with some that had not been outdoors. What items were caught in the cloth? Where did they come from? Is the cheesecloth from outdoors dirtier than the one kept inside?

5. Bring in a plant that gives off a strong odor. Discuss natural pollutants like odor and pollen.

PURPOSE: T discover what trash is and how to manage it.

LEVEL: K-
4-

SUBJECT: Scence
Soial Studies

CONCEPT: II-4 Management is the result of technical and scientific knwledge being applied in a rational direction to achieve a articular objective.

PROBLEM: IV1 Eco-Community Relationships - ecological considerations

REFERENCE: Environmental Learning Experiences for Kindergarten Through Second Grade. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: Colect the trash which accumulates in the classroom after on day. Help the students separate it into three categories: Reyclables, Bio-degradables, and Disposables.

Reyclables - Discuss some ways that this material can be reused. Sandwich bags can be used more than one time; cola bottles can be returned to the store; papers of various tyes can be re-processed and re-used. Find out how Oscar onSesame Street is using what other people throw away. Lern his song, "I Love Trash."

Bi-degradables - These are materials that will decay over a shrt period of time. In a plot on the school yard, bury soe samples of bio-degradable trash; unearth this trash periodically to see what is happening. You might also bring soe paper, glass, or metal trash at the same time for comparison. Discuss compost piles and organic fertilizers.

Diposables - This is trash that will not decay and cannot berecycled. Is there some recyclable material that could have been substituted for disposable material. For example, using returnable bottles instead of throw-away cans. Discuss the local disposal system. What will happen to this trash?

PURPOSE: To develop the concept of a closed system and apply this concept to the earth.

LEVEL: K-3
4-6

SUBJECT: Science
Social Studies

CONCEPT: I-4 In any environment, one component--such as space, water, air or food--may become a limiting factor.

PROBLEM: IV-12 Eco-Community Relationships - effects of humans on ecosystems

REFERENCE: "Closed System." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: Develop the concept that the earth is merely a small part of a very large system. It is the only planet that we know for sure has the ability to support life as we know it. Using cardboard cutouts, build a solar system in relative size. Using empty appliance boxes build a model spaceship. Have students determine all the necessities that must be included in order to make a space flight; this is a closed system. Plan a simulated flight. How much of each necessity should be included? Is there enough space for all the supplies? How many people can the supplies support? What if five extra people want to go, would you allow them to go? The earth, like a spaceship, presently contains all the air, water and soil it will ever have; and natural resources are limited. Can the increasing population be supported on our limited resources?

PURPOSE: To have students develop their sense of smell as one means of obtaining information about their environment.

LEVEL: K-3

SUBJECT: Language Arts

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: I-1 Aesthetic Considerations - odor

ACTIVITY: Early in the morning have the students go outside the school building to some shaded part of the school grounds. While standing or sitting quietly have them take several deep breaths of air, inhaling slowly - sensing the air as it comes through their nose. After quietly breathing deeply several times, let the students write down or say words which describe the air they are breathing or the way they feel about the air.

Repeat this procedure several times during the day--before lunch and at the end of the school day. Always try to find a quiet, shady spot to carry out the exercise so the students will be less distracted by other factors. Students should be particularly aware of odors, difficulty in breathing, moisture in the air, and so forth.

Have the students compare their word lists written at various times during the day.

When is the air the freshest?
Does the moisture in the morning air help to make it clean?
What kinds of smells are discovered during the day?

This exercise can also be done in special settings, such as a forest, classroom, cafeteria, department store, downtown, and so on.

PURPOSE: To develop students' senses as tools to be used in environmental awareness.

LEVEL: K-3

SUBJECT: Language Arts

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: I Aesthetic Considerations

REFERENCE: "Earth Bound: Communications in Environmental Education." Environmental Education Center, 13 Veterans Drive, Oteen, N.C. 28805.

ACTIVITY: Feel-A-Sight: Go outside and see colors or objects that make you feel angry, happy, bored, confused, depressed, peaceful, active. In the classroom tell what colors or objects you found.

Feel-A-Touch: Go outside and find things to touch that make you feel warm, cold, comfortable, lazy, cautious, weak, strong. In the classroom, tell what objects you found.

Feel-A-Sound: Go outside and bring back sounds (a tape recorder would be useful) that make you feel angry, sad, beautiful, afraid, tense.

Feel-A-Taste-'N'-Smell: Go outside and find things to smell or taste that make you feel cold, alarmed, hungry, curious, thirsty. (The teacher should use caution with this activity.)

PURPOSE: To become more aware of beauty in our environment and our responsibility to maintain or create beauty.

LEVEL: K-3
4-6

SUBJECT: Language Arts

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: "Mini-Lessons on Environmental Awareness," Union County Schools, Lake Butler, Florida.

ACTIVITY: Discuss with the children what they consider to be beautiful things in their environment. Help the children understand that objects such as trees, flowers, birds, animals, sunsets, clouds, snow, and bodies of water are naturally occurring beauties while objects of art, musical instruments, toys, and similar objects are man-made.

Involve the class in developing on the chalkboard a list of beautiful things in the environment that can be classified into categories of living and non-living objects. Invite class members to explain what, if anything, they can do to maintain or create some of these beautiful things.

Teachers of second and third grade children might continue the activity by asking pupils to write all the letters of the alphabet on a sheet of paper. Select a letter, ask the children to sit with closed eyes for a few moments and think of something beautiful that begins with that letter. Invite pupils to spell that which they have chosen.

The activity can be continued through the letter of the alphabet as long as interest remains high. Obviously many opportunities will be available to see how many pupils select the same things and to have pupils explain why they choose as they do.

PURPOSE: To develop written expression of feelings toward polluted environments.

LEVEL: K-3
4-6

SUBJECT: Language Arts

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I Aesthetic Considerations

REFERENCE: Environmental Education Guide - Art 4-6. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: With the class visit a site of environmental pollution. This could be an eroded bank, a litter-strewn lot, an industrial complex with belching smoke, or a noisy street corner. Have the students write down as many words as possible that express how they feel at that moment about the scene before them; or the teacher may want to compose a master list as students verbalize their feelings. If it is not possible to visit an actual site, slides or pictures may be used. However, the full input of sights, sounds, and odors will be missing without an on-site visit. Back in the classroom have some of the students read their lists aloud. What words re-occur? Do the words mean the same thing to all the students. What words may be used in place of the over-worked words?

If the reaction is negative toward the environmentally polluted site, what can be done to change the site? How can more people be made aware of the environmental pollution? Can the words in the list be used to convey the feelings of the students to responsible persons?

PURPOSE: To demonstrate uses that can be made of discarded items.

LEVEL: K-3

SUBJECT: Fine Arts

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: I-4 Aesthetic Considerations - litter

REFERENCE: Recycle. The Children's Museum Resource Center, Boston, Massachusetts.

ACTIVITY: By using materials which are normally discarded in the home, children can make musical instruments. The concept of re-using (recycling) materials can be involved in this exercise. Some music makers that can be constructed are:

Drum - Use tin cans and cardboard boxes and containers; these can be decorated with paint or paper and glue. Drumsticks can be made from clothespins or pencils.

Rattle - Use any lidded container such as jars or boxes; even paper bags may be used. Dried peas, beans or macaroni can provide the "rattle."

Tambourine - A pie tin or similar aluminum container provides the basic structure; small bells or bottle caps can be attached with string or wire for the finishing touch.

Finger Cymbal - Bottle caps can be fastened to fingers by looping elastic thread through holes punched in the bottle caps.

Kazoo - Cardboard tubes from toilet paper, toweling or tin foil rolls provide the basic structure. Cover both ends of the tube with wax paper secured with rubber bands. Punch holes down one side of the tube; hum or "toot" into one end, and with a little practice, a kazoo is born. A comb kazoo is easy to make with a discarded comb and wax paper.

Bells and chimes - Obtain 8 glasses or bottles of uniform size. Fill these with varying amounts of water. (Colored water would be pretty.) By striking these with mallets, wooden or metal spoons, tunes can be played. If the containers are suspended by string from a frame, the sound will be completely different.

Wind chimes - Collect popsicle sticks, tongue depressors, nails, or similar flat pieces. Using varying lengths of string suspend them from a frame. When wind blows through the chimes, you will be amazed by the tones produced; gently moving the chimes may also produce similar sounds.

PURPOSE: To demonstrate how some discarded materials can be reused with a little imagination and creativity.

LEVEL: K-3
4-6

SUBJECT: Fine Arts

CONCEPT: II-2 The relationship between man and the natural environment are mediated by his culture.

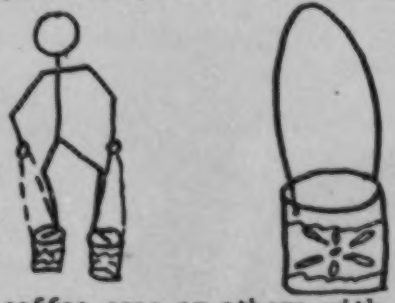
PROBLEM: I-4 Aesthetic Considerations - litter

REFERENCE: "Art Is a Way of Living." Environmental Education Center, 13 Veterans Drive, Oteen, N. C. 28805.

ACTIVITY: Have students collect discarded cans of various sizes and shapes. With some imagination and creativity these cans may be "recycled" for different uses or given as gifts. Some possibilities are:

1. Containers - Cover or paint and decorate to hold pencils, mail and "stuff." Cover with material, decorate with braid, ball fringe, or natural objects like pine cones, burrs, acorns, and so forth.

2. Stilts - Use large juice cans. Decorate with latex paint, wallpaper, contact paper, wool, felt. Punch holes in either side of can near top edge. Run heavy twine or cord through can and tie to length desired; step on can, pull cord tight to hold cans on and walk.



3. Doorstops or Bookends - Use coffee cans or others with plastic tops. Fill cans with sand, cover with plastic tops. Decorate with felt, paint, braid, or other material.

4. Lanterns - Fill cans with water and freeze; ice will prevent cans from bending when you punch holes. Make design by punching holes with nails of varying sizes; design should be drawn on can first. Glue or screw on a bottle cap in bottom of can to hold candle. Add wire if lantern is to be hung.

PURPOSE: To use music as a means of learning about transportation problems.

LEVEL: K-3
4-6

SUBJECT: Fine Arts
Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: I-9 Aesthetic Considerations - traffic control

REFERENCE: Environmental Education Guide - Music K-3. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Have the class make a list of songs that deal with modes of transportation. This list may include "Casey Jones," "Old Paint," "Marching to Pretoria," "Up, Up and Away," "Leaving on a Jet Plane," "Jingle Bells," "Row, Row, Row Your Boat," "Merry Oldsmobile." As several of these songs are learned and sung, discuss how modes of transportation have changed and why these changes have occurred. Arrange the songs in chronological order; does the list demonstrate how transportation modes have progressed? How did primitive modes of transportation limit the spread of population? How have changes in transportation caused changes in the environment? As new fuels were used in transportation how has the environment been affected?

GRADE LEVEL 4 - 6

Activities	
Science	13
Science-Social Studies	3
Science-Mathematics	1
Science-Fine Arts	1
Science-Language Arts	1
Mathematics-Science	1
Social Studies	12
Social Studies-Science	2
Social Studies-Home Economics	1
Language Arts	4
Language Arts-Social Studies	2
Fine Arts	2
Fine Arts-Social Studies	1
Fine Arts-Language Arts	1

PURPOSE: To identify some of the causes of erosion.

LEVEL: K-3
4-6

SUBJECT: Science

CONCEPT: IV-1 Organisms and environment are in constant change.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: A View of the Environment - Outdoor Classroom, Camping, and Recreation. Conservation Curriculum Improvement Project, South Carolina State Department of Education, Columbia.

ACTIVITY: Take the students on a field trip to view some places where erosion has occurred. A ditch or gully on the school site would be a good place to start. If possible, compare these sites with sloping areas that are covered with vegetation and do not show signs of erosion. Elicit from the students what characteristics of the land may have allowed erosion in the first instance but not in the second instance. The students should mention slope, lack of cover, and particulate nature of the soil. Examine eroded soil for the presence of animal life. If possible visit the eroding sites during or immediately after a rain storm. Measure the eroding sites and determine if they are getting larger as erosion continues.

Adopt an erosion site. Decide what steps to take to prevent the continuation of erosion, and follow this procedure on your site. Try various methods at different sites--for example, planting grass, diverting the water flow, stair-stepping (terracing) the site, and using leaf litter to slow the water flow over the site.

PURPOSE: To show one cause of erosion and rock break-up.

LEVEL: K-3
4-6

SUBJECT: Science

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: A View of the Environment - Outdoor Classroom, Camping, and Recreation. Conservation Curriculum Improvement Project, South Carolina State Department of Education, Columbia.

ACTIVITY: The effect of alternate freezing and thawing on rock surfaces can be easily demonstrated in class or by the students at home. Fill a plastic container full of water, and place it in a freezer. As the water freezes and forms crystals, the resulting ice block will occupy more space than the original water; the expansion of the ice will crack the plastic container demonstrating the force of the expansion. If a small container is used, the water will freeze faster.

After demonstrating the force of expanding ice, use the same procedure to show the effects of the force in breaking up rocks. Obtain several types of rocks--some porous ones should be used. Soak the rocks in a water bath for a short period of time (for the porous rocks it is important that sufficient time be allowed for the water to penetrate throughout the rock). Place each rock in a separate plastic bag, and put each in a freezer overnight. The next day remove the rocks, allow to thaw, and observe the presence of rock debris broken off by the freezing-thawing process. Soak the rocks again and repeat the freezing-thawing steps.

Stress the point that in nature this freezing-thawing process occurs over many years and slowly breaks down the rock into soil particles. In the field observe soil and rock particles of various sizes; each is being acted on further by the expansion force of ice.

PURPOSE: To understand how animal activities affect water infiltration and run-off in soil.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: IV-4 Man has been a factor affecting plant and animal succession and environmental processes.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: Environmental Education Guide (Biology) Project I-C-E, (Instruction-Curriculum-Environment) 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Ask pupils to bring to class one or two small frozen juice cans with both ends removed. Have the cans marked so that they can be pushed or driven exactly two inches into the soil. Agree that in each test exactly 50 ml. or some other appropriate amount of water will be put into the can. Plan also to record the time required for the water to enter the soil.

Ask children to work in pairs or threes and select four obviously different types of soil and determine infiltration rate for each location. A hard packed walkway on the school ground might be compared, for example, with a portion of unused lawn. A heavily grazed field might be compared with an ungrazed field.

Organize data obtained by each group of pupils into a table that shows relationship between kind of soil and infiltration rate. Is it true that animals, including man, affect water run-off? What difference does it make if rainfall runs off of soil rather than sinks into the ground?

PURPOSE: To examine energy use in a school building.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Energy, Key to the Future - Teaching Techniques for the Understanding and Conservation of Energy K-12. Dutchess County Board of Cooperative Educational Services, RD #1 Salt Point Turnpike, Poughkeepsie, New York 12601.

ACTIVITY: Arrange with the custodian for the class or for a small group of pupils to visit the school's heating plant. Ask that he describe simply how the heating system works, how heat is distributed throughout the building, the problems he has had or anticipates regarding an adequate fuel supply.

Ask the custodian also to explain the energy requirements (other than heat) needed to operate the school. What are the total energy costs of operating the school per month? Per day? Has the school temperature been lowered to conserve energy? What other conservation methods are being used?

Involve the class in making a large bulletin board display to show the types of energy used in the school and where the sources of this energy originate. Ask children to make and post drawings or slogans that remind them of what they can do to save energy.

PURPOSE: To show ways home heat loss can be reduced.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: III-3 Environmental management involves the application of knowledge from many different disciplines.

PROBLEM: IV-4 Eco-Community Relationships - energy production

REFERENCE: Living Within Our Means: Energy and Scarcity. New York State Education Department, Albany, New York.

ACTIVITY: Use two small, identical beakers and two shoe boxes. Insulate one of the boxes (cover box edge) as well as possible, using paper, cotton, ceiling or roof insulation, etc. Leave the other box uninsulated, and make a few small holes in it. Insert a thermometer in a slit in the top of each cover. Pour the same amount of boiling water into each beaker, place them in the boxes and quickly cover the boxes. On the insulated box, be sure that the crack around the thermometer has been well sealed, and that the lid is sealed onto the box. Ask children to predict what they think will happen, and to explain their predictions. Watch the thermometer and note changes in the temperature of the water in each box. Discuss the results. Use the experiments as a lead-in to discuss insulation in our houses.

Which construction materials provide the best insulation? What is a thermopane? How is it used? Why is it used? Why is it not used in some houses? (It is expensive.) Is good insulation important only in the winter when fuel is being used to heat the house? Explain. What is the advantage of storm windows and doors? What kinds of materials are used for insulating houses? Prepare a display of some of the more common ones. How can room decorating (rugs, draperies) help in insulation? What steps can the average homeowner take to achieve better insulation? (Caulking of windows, storm sashes covering air conditioners in winter, and keeping fireplace drafts closed when not in use, are examples.) If a well insulated house saves money in fuel for heating and electricity for air conditioning, why are more new houses not better insulated?

PURPOSE: To demonstrate soil erosion and how to prevent it.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: Environmental Learning Experiences for Grades Five and Six. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: Construct two small soil boxes about 16" long, 12" wide, and 4" deep. Make the boxes waterproof by lining them with heavy plastic material. At one end of each box cut a V-shaped notch 1 1/2" deep, and fit the notch with a tin spout to draw runoff water into a container (see diagram). You will need two large flower sprinklers (quart or half gallon) to simulate rain; also obtain two half-gallon wide-mouth jars to collect the runoff water.

Fill both boxes with the same rich soil. In one box scatter grass seed thickly and allow the grass to grow to a height of about one inch. An alternative to growing the grass plot is to cut a piece of sod from a pasture or lawn and fit this into the box; if students can assist in bringing in the sod, this may be a more meaningful experience. Now the boxes are ready to use.

Raise one end of the boxes 2" or 3". Fill the two sprinklers with water and pour the water in the raised end of the boxes at the same time. Hold the sprinklers at the same height and pour at the same rate thus simulating rainfall. Collect runoff water from the boxes into the empty jars.

Which box had the most runoff? Which box had the runoff with the most soil? Which box shows the most evidence of erosion?

Discuss the value of ground cover in preventing erosion. What other types of ground cover are there? On roads, straw is used to prevent erosion; try this in one of the boxes.

The boxes can also be used to demonstrate the value of contour plowing on hillsides.

PURPOSE: To show the amount of top soil loss due to erosion.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: Teaching Soil and Water Conservation. Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

ACTIVITY: There are several ways of measuring the amount of soil lost due to erosion. One way is to measure the average size of a gully which has resulted from water washout (see Wheatley and Coon, 100 Teaching Activities in Environmental Education, V.I. page 144-145). Two additional techniques are presented here.

One way to see soil loss is to compare the soil profiles of a cultivated field and a pasture. Find a cultivated field where the slope has at least a 5-foot fall in 100 feet of horizontal distance. Try to find a field that has been in cultivation for some time. You can check this information about the farm with the owner or the neighbors.

Dig a small hole deep enough to get below the topsoil layer. Then cut off a slice an inch or more thick along the vertical side of the hole. Lay this slice on the ground and study it. Note the depth of the topsoil layer. Study the structure, i.e., how the particles are held together. Are they tight and does the soil hold together in large lumps (clods)? Is it crumbly like cake?

Dig another hole in the fence row at the edge of the field or just across the fence in a pasture that has not been plowed. Try to dig the second hole at about the same point on the slope and as close to the first one as possible. Study the soil layers as you did with the first sample. Lay the two samples side by side and compare them. Compare the depth of the topsoil layer and the structure of the soil.

A second technique to demonstrate soil loss is the size of a gully as it enlarges over a period of time. Find a gully that is cutting deeper and further into the field with each rain. Drive wooden pegs 10 to 15 feet about the gully head and on each side of the fully. After each rain, measure from each stake to the nearest edge of the gully to see how much the gully has grown. Do this after several rains and compare your measurements to see how much the gully has grown since you first set the stakes. By measuring the width, depth, and length of the gully, figure out how many cubic feet of soil have been lost.

PURPOSE: To make students aware of the large number of energy-using items which are found in the home.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-4 Eco-Community Relationships - energy production

REFERENCE: Energy. Environmental Education Project, Topeka Public and Parochial Schools, Topeka, Kansas 66612.

ACTIVITY: A large amount of energy is used in our homes to make us more comfortable, for recreation, and to make our work easier. To increase student awareness of home uses of energy have each student take home and complete the "Home Use of Energy Check List." Students, with their parents' assistance, if desired, can complete the check list. Explain that you do not want names on the sheet. This should help set a more realistic answer on some of the questions. To help the students understand the sheet, fill one out using the school as the home having all students work together. This would be a good time to have your students tour the parts of their school that they do not normally visit. The rankings will vary with each person's opinion. Reasons for rankings could lead to a very interesting and worthwhile discussion after the check list is completed.

The "Home Use of Energy Check List" should include as many home items that use energy as possible. For each item present, the student may indicate (if possible) the number present in the home, amount of energy required (many items list their wattage or BTU's; this will be important in determining the biggest energy users), type of energy going into the item (e.g., gas, electricity, battery, man's energy), type of energy being used in the end (e.g., heat, light, motion), and number of hours used per week. These questions can be arranged along the horizontal top of a chart with the list of home items forming the vertical left border. Make the list of home items as extensive as possible; some you may include are:

electric radio
portable radio
can opener (electric)
can opener (manual)
stove
refrigerator
dishwasher
toaster
telephone
hand saw
grill
clock
record player
candles
broom
fan
mop
electric razor

lamps	fireplace
television	toothbrush
pencil sharpener	flashlight
hair dryer	knife
doorbell	garbage disposal
water heater	car

After check lists are completed use them to discuss the following: (1) How is energy used in our homes? (2) In what form(s) is energy entering your home? (3) What form is the energy changed into within the home? (4) What uses in the home consume the most energy? (5) How does the home uses of energy benefit us? and (6) Which of these uses could we do without?

PURPOSE: To show the amount of residue found in polluted waters.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: I-6 Aesthetic Considerations - water quality

REFERENCE: Water Pollution. Environmental Education Curriculum, Topeka Public and Parochial Schools, Topeka, Kansas 66617.

ACTIVITY: Have students collect samples of water from different places; streams, ponds, puddles and gutters are good sources for collecting. Shake up the samples and place a teaspoon of each in a separate dish. Let the sample evaporate. After the water evaporates, there will probably be a residue of some sort in each dish.

Examine the residue carefully and discuss questions such as the following:

How did the residue get there?
Is the residue harmful?
How can the residue be prevented from entering the water?
How can the residue be removed from the water?
How can be residue in the water be made harmless?

Which way is easiest for rendering the water safe from the residue? Which way is the least expensive? Which ways are currently used?

PURPOSE: To show particulate contamination of the air.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-10 Eco-Community Relationships - effects of air quality on ecosystem

REFERENCE: Teachers Curriculum Guide for Field Ecology. Center for Environmental Education, 705 Avocado Avenue, Cocoa, Florida.

ACTIVITY: Obtain several glass or plastic jars from the school cafeteria. Wash the jars thoroughly and rinse twice with distilled water.

Place approximately 4" of distilled water in the jars and set the jar outside to collect particulate matter from the air. Locate the jars in an open area, several feet above ground level to prevent material being blown in from the surface. Leave the jars in place for 30 days; add distilled water from time to time to keep the jars from drying out.

After the sampling period, bring the jars inside. Obtain several evaporating dishes and weigh them. Place the water from the jars in the evaporating dishes. Wash the jars with distilled water; add the wash water to the evaporating dishes. Evaporate the water slowly. When the water is gone, weigh the evaporating dishes again. Subtract the first weight from the second; this will be the weight of the particulate matter from the air.

Compare the result from different areas with respect to temperature, wind direction, industrial locations, rainfall, and other climatic conditions.

PURPOSE: To trace the flow of water from the faucet to its source emphasizing man's dependency upon the continuous recycling of many substances.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Turn on a water faucet in the classroom, in the hall or on the school grounds and permit the water to flow into the drain. After a short time of observing the water flow, ask the students "Where does this water come from?"

Trace the water flow through the hydrologic cycle including steps such as: School and community water supply; water treatment plant; river, well or reservoir; underground aquifers; evaporation and transpiration; condensation and precipitation.

Discuss ways that water may be polluted on its way to the faucet such as: Biological wastes from organisms in water; dirt, dust, erosion, and sediments; fallen material - leaves, branches, tin cans; agricultural losses - erosion, fertilizers, insecticides, animal wastes; industrial wastes - chemical and thermal pollution; community wastes - sewage, storm water, household products.

PURPOSE: To show the transformation of energy from one form to another in an energy chain.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: IV-1 Organisms and Environments are in constant change.

PROBLEM: IV-4 Eco-Community Relationships - energy production

REFERENCE: Energy and You. Environmental Education Curriculum, Topeka Public and Parochial Schools, Topeka, Kansas 66617.

ACTIVITY: This activity can be used to motivate the students into tracing power (movement of air) back to its original energy source (the sun) and speculating on further uses of this mechanical energy.

Have the students construct several pinwheels from construction paper, a straight pin and a small stick (pencil). Using a breeze from a window or door opening, demonstrate the production of mechanical energy. Since energy cannot be created or destroyed, let the students trace the energy pathway backwards as far as they can. We usually regard the sun as the ultimate energy source, but is the sun "creating" energy or just changing its form?

The rotating pinwheel is mechanical energy. In what ways can this energy form now be used. Let the students use their imaginations. Can a house be supplied with all its energy fom a giant pinwheel? (Such houses are actually in operation on an experimental basis.) What are some problems involved with wind energy?

PURPOSE: To enable pupils to understand that noise affects rate of heartbeat.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: I-5 Aesthetic Considerations - noise

REFERENCE: Sounds and Noises. Thomas L. Chapman, Madison County ESEA, Title III Project, Environmental Education Center, Oteen, North Carolina 28805.

ACTIVITY: Review with the class the procedure for determining rate of heartbeat by taking pulse rate at the wrist or at the throat. When each child is able to count his pulse rate use a stop watch or wristwatch with sweep second hand and ask each child to count his heartbeats for 30 seconds. Ask each child to calculate his heartbeat rate for one minute and record the number for future use.

Review with the class some of the things that make their hearts beat faster such as running, excitement, and fear. If not mentioned by a child,the teacher can suggest the possibility that noise may also be an influencing factor. (Previously the teacher should have selected three pupils and planned with them as to how they could go to the rear of the room and make noise by dropping a heavy book repeatedly, pounding on a tin pan, or using other loud sound-making devices.)

Indicate that each pupil should count his heartbeats again when considerable noise will be made in the classroom and follow the procedure used to get the initial "normal" rate per minute.

Ask each pupil to indicate increased, no change, or decreased beats per minute during the noisy time. If (as is likely) a sizeable percentage of the pupils have increased rates,what does this mean? What physical or mental conditions other than heartrate are sometimes affected by noise? What types of workers are particulary vulnerable to loud noises? Can/should anything be done to protect these workers and people generally from too much noise?

PURPOSE: To discover what trash is and how to manage it.

LEVEL: K-3
4-6

SUBJECT: Science
Social Studies

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Environmental Learning Experiences for Kindergarten Through Second Grade. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: Collect the trash which accumulates in the classroom after one day. Help the students separate it into three categories: Recyclables, Bio-degradables, and Disposables.

Recyclables - Discuss some ways that this material can be re-used. Sandwich bags can be used more than one time; cola bottles can be returned to the store; papers of various types can be re-processed and re-used. Find out how Oscar on Sesame Street is using what other people throw away. Learn his song, "I Love Trash."

Bio-degradables - These are materials that will decay over a short period of time. In a plot on the school yard, bury some samples of bio-degradable trash; unearth this trash periodically to see what is happening. You might also bring some paper, glass, or metal trash at the same time for comparison. Discuss compost piles and organic fertilizers.

Disposables - This is trash that will not decay and cannot be recycled. Is there some recyclable material that could have been substituted for disposable material. For example, using returnable bottles instead of throw-away cans. Discuss the local disposal system. What will happen to this trash?

PURPOSE: To develop the concept of a closed system and apply this concept to the earth.

LEVEL: K-3
4-6

SUBJECT: Science
Social Studies

CONCEPT: I-4 In any environment, one component--such as space, water, air or food--may become a limiting factor.

PROBLEM: IV-12 Eco-Community Relationships - effects of humans on ecosystems

REFERENCE: "Closed System." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: Develop the concept that the earth is merely a small part of a very large system. It is the only planet that we know for sure has the ability to support life as we know it. Using cardboard cutouts, build a solar system in relative size. Using empty appliance boxes build a model spaceship. Have students determine all the necessities that must be included in order to make a space flight; this is a closed system. Plan a simulated flight. How much of each necessity should be included? Is there enough space for all the supplies? How many people can the supplies support? What if five extra people want to go, would you allow them to go? The earth, like a spaceship, presently contains all the air, water and soil it will ever have; and natural resources are limited. Can the increasing population be supported on our limited resources?

PURPOSE: To measure personal use of water in the home.

LEVEL: 4-6
7-9

SUBJECT: Science
Social Studies

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Interdisciplinary Concepts and Activities - Grade 4. Environmental Education Center, Lee County Schools, Fort Myers, Florida.

ACTIVITY: Before indoor plumbing and water was piped into our homes, people used an average of 4 to 5 gallons of water per day. Today the average American uses 60 gallons of water per day. Much of this is water that is wasted simply because the supply is readily available.

Have each student determine how much water he uses each day for a week by using the following chart:

How Much Water I Use in the Bathroom

Use of Water	Amount of Water Used	Number of times done						
		S	M	T	W	T	F	S
Washing hands in sink	Cups							
Washing face in sink	Cups							
Brushing teeth	Cups							
Drinking water	Cups							
Taking bath	Gallons							
Taking shower	Gallons							
Flushing toilet	Gallons							
Total Number of Gallons Each Day								
Total Number of Gallons One Week								

Now the student needs to determine how much water he uses each time he performs one of these tasks. This can be done in the following manner:

Put a stopper in the sink. Using a measuring cup fill the sink one cup at a time. Each time a cup of water is added, mark the level of the water on the side of the sink with a pencil. (The pencil marks can be washed off when the

experiment's over.) Empty the sink, and put the stopper back in place. Now wash your hands as you normally do. What is the water level in the sink? How many cups of water did you use? Write this amount on your chart. Repeat the same process with washing your face and brushing your teeth.

To determine the amount of drinking water, measure the number of cups of water your bathroom glass holds. Mark this on your chart.

To find how much water you use to bathe, take a bath and mark the level of the water in pencil. Next, stopper the tub and take a shower; mark this water level. Empty the tub to the "shower" and "bath" levels; enter the number of gallons for each on your chart.

To measure the amount of water in your toilet you will need the help of a friend. Take the top off the toilet tank. Have a friend hold the float in position while you dip the water out of the tank and measure the number of gallons. This water is clean so don't worry about it. Enter the measurement on the chart.

Each student should keep track of his water uses for a week. Determine how much water is used. How much water would you save if you took only showers instead of a bath? Is it necessary to use so much water in flushing the toilet? You can reduce the capacity of your toilet tank by putting a brick in the tank; this would take the place of approximately 2 pints of water (1/4 gallon). How much water would this save in a week?

Are there other ways to save water?

PURPOSE: To measure the steepness of a slope.

LEVEL: 4-6
7-9

SUBJECT: Science
Mathematics

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: "Conservation Activities for Girl Scouts." Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

ACTIVITY: Slope is an important factor in determining proper land use. It often decides whether a piece of land should be used for grass, trees or cultivated crops. It is also a consideration when selecting sites for homes, highways, sanitary landfills, parks, or other uses.

Length and steepness of slope, together with the type of soil and the kind and amount of vegetation, affect the speed of runoff and the amount of erosion. The steeper the slope, the faster will be the flow of water and the greater the amount of soil that can be carried with it. The longer the slope, the more chance runoff can pick up speed and move increasing amounts of soil.

To measure the steepness of slope you will need a yardstick, straight stick exactly 50 inches long, and a carpenter's level or a flat bottle half full of colored water. If you use a bottle, lay it on its side on a level surface; with a pencil or a piece of tape, mark a straight line along its side following the top of the water level.

Select the site where you want to determine the slope. Place the 50 inch stick on the ground running in the direction of the slope. Place the carpenter's level or the bottle on the stick and raise the lower end of the stick until the stick is level as indicated by the bottle or level. With the yardstick measure the distance from the bottom of the stick to the ground in inches. This figure drops over a distance of 50 inches. If you multiply the figure by 2, you will get the percentage of slope.

PURPOSE: To use creativity in showing examples of uses and forms of energy.

LEVEL: 4-6

SUBJECT: Science
Fine Arts

CONCEPT: IV-5 Increasing human population, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-4 Eco-Community Relationships - energy production

REFERENCE: Energy. Environmental Education Project, Topeka Public and Parochial Schools, Topeka, Kansas 66612.

ACTIVITY: Have the students bring pictures illustrating examples of energy, ways it is used, and different forms of energy. Use the pictures to construct a bulletin board collage with the word "Energy" in the center. As students put up their pictures, have them explain to others how the pictures relate to energy. Hopefully the variety of pictures will include many facets of our life, since energy is involved everywhere. At this point it will be interesting to see if any student includes the sun and realizes it is the original source of all forms of energy. Do the pictures illustrate energy used by living organisms as well as energy used by nonliving things in our world?

Continue to develop the energy picture collage until all students realize that no part of their life can exist without energy. Use the pictures to illustrate how energy is changed from one form to another; for example: sun's light to green plants, to cool, to heat, to electricity, to light.

PURPOSE: To facilitate awareness of environmental concerns and to demonstrate the use of non-verbal communication.

LEVEL: 4-6
7-9

SUBJECT: Science
Language Arts

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I Aesthetic Considerations
IV Eco-Community Relationships

REFERENCE: Environmental Science Study Project. Man and His Environment. P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: Before class write on separate strips of paper the following phrases: you are litter on the highways; you are a fish dying from lack of oxygen; you are human sewage polluting a river; you are a fish filled with poison such as mercury; you are an automobile with a very dirty, poisonous exhaust; you are a litterbug; you are the last living member of a species; you are a harmful pesticide. (The teacher may want to supplement or alter these.)

Divide the class into small groups of 3 or 4 students. A random method (such as "counting off") might be used so that the students will be grouped with other students they may not be acquainted with.

Explain that each group will become whatever is written on their strip of paper. All have to do with environmental problems caused by man. They will be given five minutes to develop a pantomine that will enable the rest of the students to guess what they are. The students can do anything but talk.

When five minutes have elapsed, let each group present its charade. You may want to time how long it takes for the class to guess each identity.

Ask the students if they found it difficult to communicate their ideas without being able to talk and listen. Point out the need for sharpening their other senses if they want to be environmentalists. Ask them why this is necessary. They should realize that environmental problems are usually seen or smelled. A dead fish or poisonous exhaust won't shout its presence!

PURPOSE: To become aware of the enormous energy used in the United States to produce "throw-away" glass containers.

LEVEL: 4-6
7-9

SUBJECT: Mathematics
Science

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: Ask students to save for one week all "throw-away" glass containers that normally go into their trash or garbage cans at home. Ask that they weigh the collection and report the weight to the class. From the sample of responses have students calculate the total weight of glass thrown away by all of the families represented in the class during a week, month, and year.

Secure from a glass manufacturing company an estimate of the number of cubic feet of natural gas needed to produce a ton of glass bottles. Have students calculate the cubic feet of gas used to produce the thrown away bottles per week, month, and year. Compare the amount used to produce a month's supply of throw aways with the amount used to heat an average home (or better still, their own, if gas is used) per month.

Should we reduce our use of throw away bottles to save energy? Why? Why not? Who would be hurt? Who would be helped? What, if anything, do students plan to do about this matter?

PURPOSE: To examine potential waste in the breakfast food industry.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

ACTIVITY: Develop on the chalkboard a master list of ready-to-eat breakfast foods commonly eaten by class members.

Ask for two or three small groups of volunteers to take the list to different large supermarkets and identify the ones available for sale. Add to the list any additional breakfast cereals available that students had not identified.

Classify the breakfast foods according to major ingredients. Calculate cost per ounce or gram. Compare costs with a simple standard cereal such as regular rolled oats.

Ask the class to explain why there has been a very large growth during the past thirty years in the number and variety of breakfast foods available. Suggest that parents be asked to also explain why this growth has occurred. Do pupils and parents agree?

Does it cost a large company more to make a large variety of breakfast food than if it made fewer? Why or why not?

If you were trying to get people to use a new cereal how would you go about it? If your plan cost money where would it come from? Would you expect the people who bought your cereal to pay part or all of the cost?

PURPOSE: To investigate what is needed to keep the school, as a community, operating. To show the interdependence of people and materials.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: III-3 Environmental management involves the application of knowledge for many different disciplines.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: "Investigating the School Environment." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: The teacher should stress the role of the school as a community. The class as a whole, or in small groups, should undertake the investigation of the various components of the school community. Help the students identify major functions and requirements of the school. The big question is "what do we need to keep the school going?"

Some areas to investigate:

1. The School Building (inside and out) - Consider the number of windows and doors, flow of traffic into and out of the building, uses of the various rooms, different colors of paint used in the building. Draw a diagram of the school. When was the school built? Has it changed over the years? How is the building situated on the land? Is the landscape attractive?

2. Building Maintenance (inside and out) - Talk with the custodian to learn what is done to keep the school clean and nice. How many people are needed each day to care for the building? What part of the cleaning takes the longest to do? What can students do to reduce the amount of time?

   What kind of litter do you find in the halls? In the classroom? In the cafeteria? Keep a record of what is thrown away in each of these areas. Ask the custodian to show you what is done with the garbage from each of these areas.

3. People in the School - List the kinds of workers in the school; include students, teachers, nurse, secretaries, cooks, librarians. Interview some of these to find out what they do. How many children are in the school? Make a graph of the number of students in each grade. Is the number the same for each level? How many children were there five years ago? Where in the community do the

students come from? During the day, where are the most students in the building? Where is there the most noise? The least noise? Does the noise disturb other classes?

4. Energy Sources

Heat - How is it generated? What is the fuel? How much does it cost? How long does it take to get the building warm enough to use on a cold winter day? Are all the rooms the same temperature? How can heat be saved in the building?

Electricity - What is it used for? Where does it come from? Are all the lights necessary? What machines use electricity? Does the furnace need electricity?

Water - List all the ways water is used in the school. Is the water coming from a faucet in the school just like rainwater? How is faucet water treated and why? What happens to the water that goes down the drain?

Food - Energy for people. How much food does the cafeteria use a day? How many children eat in the cafeteria? How many bring their lunch? How much does a meal cost to prepare? Does the student's lunch money pay the whole expense? Who plans the menus? What do students like? Are the meals balanced?

PURPOSE: To allow students to observe the amount of waste paper that is generated by a class during a week's time.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Paper Waste in Elementary Schools." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: During this activity the students will collect all the waste material from the class for a week. Obtain large cardboard containers from the custodian for this purpose. Weigh the empty containers. Bathroom scales can be used for this purpose. During the week,collect all waste materials; weigh the containers with the waste paper at the end of the week. Determine the weight of the waste paper by subtracting the empty container weight from the full container weight. Assuming the amount of waste material collected by one class is an average for a normal class, determine the amount of waste material (by weight) that is accumulated by all classes in the school during a week.

What happens to this waste paper? Does the community allow open burning? Should it? How much of the waste paper could be reused in useful ways? (Possible uses are scratch paper, paper mache materials, fireplace logs made by rolling the paper. Can paper be recycled to be used again?

PURPOSE: To study industrial growth.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Environmental Education Guide - Grade Five. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: On a city map, locate various industries found in the area. Select representative examples of the various kinds of industry. Divide the class into groups and have each group select the industry it would like to research by interview.

Have the class prepare a list of questions to be asked on the interview. These might include:

Name of interviewer
Name of person being interviewed
Type of industry represented
Date of interview
How many people are employed in your firm?
How many people have been hired in the past year?
How many people have been released from their job (laid off) in the past year?
In the up-coming year, estimate the number of people you might hire_____ Lay off_____

From this activity, students should learn what factors contribute to industrial growth and how this growth affects the local area.

PURPOSE: To demonstrate the dependency that all countries have on each other and show the earth as an integrated environment.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Environmental Education." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Assign students the task of listing 10 major imports and 10 major exports for each of several countries including the United States. The information obtained should then be featured in chart form showing the sources of all these traded products. These interrelationships can be illustrated by using a world map and connecting the trading nations with thumb tacks and colored string.

Discuss the diverse nature of the goods traded and their importance to the nations which buy them. Consider questions such as the following:

Why do countries import goods?
What responsibilities do nations have to each other in international trade?
What could a country do if certain raw materials or manufactured goods were no longer available from other countries?
Are raw materials equally distributed around the world?

PURPOSE: To develop an awareness of noise pollution and its sources.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human population, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I-5 Aesthetic Considerations - noise

REFERENCE: Environmental Learning Experiences for Grades Five and Six. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: One of the first steps in making students aware of noise pollution is to have the class visit sites of various kinds of noise pollution; if field trips are not possible, then the teacher should visit such sites with a tape recorder and record the sounds at each stop making sure the volume control of the tape recorder is on the same setting at each site. Possible sites to visit are a quiet room (for comparisons), school hall when classes change, room with normal conversation, a busy traffic intersection, industrial plant, and an airport. Have students separate and identify the sources of the sounds they hear.

Noise pollution can be broadly divided into two classes - cultural "noise" and physical "noise." Cultural "noises" are those sounds that are unpleasant to hear. These sounds are often mediated by the culture in which one lives. Adults often think that teenagers' rock music is noise; a country cousin may think the quiet city nights are noisy; airplanes passing over a residential neighborhood is an out-of-place noise. What factors determine if a sound is a cultural "noise" or not? Does peer pressure have an effect on this? A school corridor between classes may be as loud as a traffic intersection but may not be considered noisy. Why?

Physical "noises" are those sounds which physically damage the human auditory system. Loud sounds deaden sensory cells in the ear; this is a function of loudness and time. A physical "noise" may not be a cultural "noise"; certain levels of sound in rock music are physically harmful. Visit an industry (or have an industry representative come into class) and find out how workers are protected from physical "noise."

PURPOSE: To study the effects of damming rivers and streams.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Study and discuss the effects of damming rivers and streams. Build a model dam in the classroom, using a stream table or a similar arrangement. If a small stream is available on school property, use it to demonstrate the effects of damming. Emphasize the following ideas during this study:

Alteration of water velocity - effect on flood control, on organisms living in the stream, on communities down stream

Alteration of water temperature - how much is the temperature affected (write to a local reservoir or take actual measurements) effect on organisms

Erosion - where will sediments collect; what is the site of accumulation; what is the "life expectancy" of a reservoir.

Uses of water impoundment - flood control - this is often a major reason for building a dam; is this reason always appropriate? Are there laws governing the building of structures on a flood plain? What other use can be made of a flood plain?

Community water supply - how does sediment affect this?

Recreation - not all reservoirs are equipped for this type of use. What are some of the problems involved with recreation on reservoirs? (Litter, water safety, damage to dam facilities, vandalizing.)

PURPOSE: To show the amount of material wasted in excess packaging.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Land Abuse - Quality Control. Environmental Science Study Curriculum, P.S. Jones Junior High School, Washington, D.C. 27887.

ACTIVITY: If possible, take the class or a committee of students to a grocery store and have the students find examples of various types of excess packaging and try to explain the purpose of such packaging. If a field trip to the store is not possible, the teacher and students could bring various packing examples to class.

Things to notice about the packaging include:

1. What are the purposes of packaging items? Which purposes are essential (e.g., protect item, prevent spoilage) and which are non-essential (e.g. attractive colors, makes item look larger)?

2. Does the color of the package make any difference? Did you ever buy a product because you liked the way it was packaged?

3. How is the packaging of an item used in advertising the item, especially television advertisement?

4. Are all items packaged? Some items won't spoil and are easy to handle without packaging; examples are spools of thread, pens, screwdrivers, hammers, etc. Yet sometimes these items are also found in "bubble packs." What are the advantages of "bubble packs?"

5. Some items are packaged in small containers for convenience. Compare the amount of cardboard packaging in a variety pack of cereal with a single large box of cereal that holds the same amount. Open each variety, pack and measure the total area of cardboard used in the single box. Which was less expensive? What are the advantages and disadvantages of "the variety pack?"

PURPOSE: To gain an understanding of the natural factors which determine the development of a land area through a simulation game.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "The Creation and Re-creation of a City." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: The students will be shown a transparency projection of a map of an island. This particular island is well endowed with various geographical zones. The teacher will point out on the map the various geographical areas and characteristics of the island. They include:

1. Swampy region
2. Mountainous region
3. Desert area
4. Riverbeds
5. Rolling hills region
6. Timberland or forest areas

The students should be divided into groups of four or five. Each group will then discuss among its members and come up with answers to the following types of questions: You are a group of settlers. Why did you come to this island? What were some of the reasons you moved from your former home? Where do you plan to settle on the island? Why? What type of economy will you have? Where will you get the necessities of life--food, clothes (if you need them), water, etc.? What type of shelters will you have? What type of transportation will you need, if any? Assuming that the other groups settled on this island in the other three corners--How will you treat your neighbors? Will you communicate with them? Trade with them? How will you decide on the borderlines or boundaries. Give your settlement a name.

The students will be asked to draw a picture portraying life in their settlement, some of the buildings, the type of work they will be doing, how they will organize their city, plans for recreational spaces, and so forth. The members of each group will be asked to choose a method of presentation of the information about their particular group settlement. After all groups have made their presentations, skits, or speeches or whatever other method they decide upon, each student will be asked to decide which city he would rather live in and give his reasons briefly. The teacher will record the number of votes each group gets and will give the results after all students have given their choices.

PURPOSE: To have students experience a situation of crowding.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: III-2 Family planning and the limiting of family also are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.

PROBLEM: IV-6 Eco-Community Relationships - population studies

REFERENCE: Environmental Learning Experiences for Grades Three and Four. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: In this activity, students will be placed in a situation where they must work under crowded conditions. This must be in conjunction with another teacher and her class. Both groups will be put to work in their respective room doing some project that does not require direct teacher supervision. This project should involve students working individually or in small groups; they should be using equipment and facilities that are in the room, such as special paper, chalkboard, table space, etc. (The project may be, for example, to construct a collage related to an environmental problem.)

After the students have been working for a short while in their separate classrooms, merge the two classes. Place both classes in one of the two classrooms. Have the students continue working on their projects; do not increase the facilities, equipment, or supplies.

The students will soon react to the frustrations of running out of supplies, not having enough space, too much noise, too many distractions. Some arguments may occur. Break these up, but make sure the students notice these have occurred. The noise level in the room will increase; allow this to happen unless it disturbs other people in the building. After the effects of crowding have become noticeable, separate the two classes into their original classrooms. In a discussion, make the point of some of the results of crowded conditions: noise, anger, lack of supplies, reduced space, and other factors that bothered them. This may be a good time to introduce data on population growth and speculate on whether or not the earth is becoming too crowded.

PURPOSE: To examine the importance of transportation in American life.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Living Within Our Means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Mobility has always been a prominent characteristic of the American way of life. Discuss or have children chronicle this feature of our way of life which might be summarized by the phrase, "America - A Nation on Wheels."

What does the phrase mean? What industries, jobs, and activities are directly related to the various transportation industries? How are your lives and your parents' lives dependent on these forms of transportation?

Continue the discussion and divide the class into four groups, assigning each group one of the following categories of transportation as a research assignment: Cars/Trucks/Planes/Trains. The following questions might be helpful in guiding this phase of the activity:

How many people own, operate, or use a mode of transportation?

What natural resources are essential to production in, and the operation of, your industry?

How does either a decrease in supply or demand affect your industry?

How does increased demand coupled with decreased supply affect price and availability to consumers?

What effect has your industry had on the environment? What problems need to be solved?

What government practices have been initiated or have been proposed with regard to your industry? Why?

How responsive has your industry been to public demand for environmental protection?

What is your industry doing to better serve the public as well as its own interests?

As the class shares the data gathered in the form of reports, charts, pictures, statistics, and the like, have the pupils decide:

- -what priorities should these industries have
- -whether or not the public interest and the environment have or have not been adequately considered by these industries in the past
- -what actions should be taken in the future to safeguard the general welfare (public and private)

PURPOSE: To understand the increasing complexity of urban life.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "City Planning" by Mary Beth Durner for Environmental Education Center, 13 Veterans Drive, Oteen, North Carolina 28805.

ACTIVITY: The class can work together or in groups in discussing the needs of a community 200 years ago and the needs of a city today. Needs such as water, food, clothing, shelter, tools, weapons, transportation, power, government, and recreation might be identified for a pioneer community. Students should attempt to indicate what was required from people or from the environment to meet those needs in a community 200 years ago.

A similar list of needs with few additions (such as communication systems) can be developed for a present day city. Students should attempt to indicate what is required from people or the environment to meet the needs of people living in cities today.

Students, working in small groups, might draw a map of a pioneer community and show sources of food, water, manufactured goods, etc. In a simplified manner a map of a large city might be drawn showing sources of food, water, manufactured goods and services.

Subsequent discussion might focus on the major differences between early basically self-sufficient communities and present inter-dependent communities. In what respects have the changes been good or bad?

PURPOSE: To understand relationships between energy use and standard of living.

LEVEL: 4-6
7-9

SUBJECT: Social Studies
Science

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-4 Eco-Community Relationships - energy production

ACTIVITY: Review with the class the importance of slaves in enriching the lives of kings or very rich people in earlier times. With imput from the class develop a list of work done by slaves for their masters such as cooking food, carrying water, carrying people, removing garbage, cleaning rooms, securing fuel, moving air by hand-operated fans, making music, and so forth.

Indicate that each American today is likely to have the equivalent of more than 300 "mechanical slaves" at his command. What do these "slaves" do? Are we likely to want more and more such slaves in the years ahead? Why or why not? Do you believe people in less developed countries in Asia, Africa, and Central America also desire to have such mechanical slaves? If so, would this be possible?

Discuss the advantages and disadvantages associated with increasing use of such "energy slaves."

PURPOSE: To review problems and issues associated with strip-mining.

LEVEL: 4-6
7-9

SUBJECT: Social Studies
Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Living Within Our Means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Show the children pictures and/or colored slides of current strip mining operations, areas previously stripped (reclaimed as well as untouched), and the huge power machines used in strip mining. Have the children research where strip mining is most prevalent and locate these places on a large map of the United States. Discuss some of the reasons for and against strip mining to develop understanding that this is a very complex problem facing our society, especially in this period of energy shortages.

Divide the class into three groups to research further the positions taken on strip mining by the coal industry, by "environmentalists," and by the local community whose jobs often depend on the coal industry. After research in magazines, books, films, and through interviews set up a "mock hearing" in class at which each group might present its point of view on questions such as the following:

How has most of our coal been mined until recent years. What were some of the advantages and disadvantages of this type of mining?

How does strip mining hurt the environment? What is its effect on water? On flooding? On the nearby vegetation? On the appearance of the land?

What are some ways to prevent the harmful effects of strip mining? Why have these precautions not been taken before?

What is the government doing about strip mining?

Why might local people not be opposed to strip mining?

How has the energy crisis affected opinions about strip mining?

PURPOSE: To have the students consider ways that food in the home can be "recycled" and food wastes decreased.

LEVEL: 4-6
7-9

SUBJECT: Social Studies
Home Economics

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: "Recycling for Relaxation." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: As an out-of-class assignment have the students for a week keep a list of the waste food that is thrown away in their homes. Using the list in class consider how some of this food could be "recycled" or re-used.

Seeds and pits - Many fruits and vegetables have seeds that can be used for planting and growing more food. Most of the seeds would have to be washed thoroughly and dried before using. Most county extension agents have pamphlets or free material on growing specific vegetables. (Look in your telephone book under your state.

Compost pile - Most food wastes can be used in starting a compost pile which can be used for fertilizer around the home. Grass cuttings from the lawn can also be used.

"Soft" fruits and vegetables - Many foods that are not in good enough condition to serve directly can be used in making jams and jellies, or soups and stews.

Leftovers - Leftover food is often thrown away or hidden in the refrigerator until it spoils. Special creativity is needed in preparing meals from leftovers; many cookbooks have special recipes on how to use this food. Have the students find a special recipe and, if possible, prepare a meal in class.

PURPOSE: To develop written expression of feelings toward polluted environments.

LEVEL: K-3
4-6

SUBJECT: Language Arts

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I Aesthetic Considerations

REFERENCE: Environmental Education Guide - Art 4-6. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: With the class visit a site of environmental pollution. This could be an eroded bank, a litter-strewn lot, an industrial complex with belching smoke, or a noisy street corner. Have the students write down as many words as possible that express how they feel at that moment about the scene before them; or the teacher may want to compose a master list as students verbalize their feelings. If it is not possible to visit an actual site, slides or pictures may be used. However, the full input of sights, sounds, and odors will be missing without an on-site visit. Back in the classroom have some of the students read their lists aloud. What words re-occur? Do the words mean the same thing to all the students. What words may be used in place of the over-worked words?

If the reaction is negative toward the environmentally polluted site, what can be done to change the site? How can more people be made aware of the environmental pollution? Can the words in the list be used to convey the feelings of the students to responsible persons?

PURPOSE: To become more aware of beauty in our environment and our responsibility to maintain or create beauty.

LEVEL: K-3
4-6

SUBJECT: Language Arts

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: "Mini-Lessons on Environmental Awareness," Union County Schools, Lake Butler, Florida.

ACTIVITY: Discuss with the children what they consider to be beautiful things in their environment. Help the children understand that objects such as trees, flowers, birds, animals, sunsets, clouds, snow, and bodies of water are naturally occurring beauties while objects of art, musical instruments, toys, and similar objects are man-made.

Involve the class in developing on the chalkboard a list of beautiful things in the environment that can be classified into categories of living and non-living objects. Invite class members to explain what, if anything, they can do to maintain or create some of these beautiful things.

Teachers of second and third grade children might continue the activity by asking pupils to write all the letters of the alphabet on a sheet of paper. Select a letter, ask the children to sit with closed eyes for a few moments and think of something beautiful that begins with that letter. Invite pupils to spell that which they have chosen.

The activity can be continued through the letter of the alphabet as long as interest remains high. Obviously many opportunities will be available to see how many pupils select the same things and to have pupils explain why they choose as they do.

PURPOSE: To project future status of the automobile.

LEVEL: 4-6

SUBJECT: Language Arts

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Living Within Our Means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Read the following review of a scientific spoof to the children, or have mimeographed copies available. Use the questions which follow to stimulate discussion.

> An Arizona newswriter has projected our gasoline shortage 1,100 years into the future. He reports that a memo in A.D. 3100 states that during the twentieth century the earth was inhabited by huge metallic-looking beasts called "autosaurs." These monsters weighed between 1,000 and 4,000 pounds, and could travel at terrific rates of speed. Although they could be ridden, he relates, they were never completely domesticated by the natives. Apparently thousands of natives lost their lives to them each year.
>
> Around the last few decades of the century, he tells us, the "autosaurs" mysteriously disappeared. Scientists entertain the possibility of their having starved to death because of some inexplicable depletion of their food supply. A picture unearthed near Los Angeles supporting this theory shows great lines of these creatures queued up before a feeding station. One of the natives, in an obvious attempt to forestall extinction, is force feeding the leader by means of a hose injected into its "surprisingly small orifice." This effort was evidently unsuccessful.
>
> Our writer continues, "While the extinction of any species is to be mourned, it does not appear that the ecological balance of that period was upset by the autosaurs' disappearance. There is even some proof that it was improved."

Why does the name "autosaur" sound scientifically valid?

What characteristics does the writer attribute to the "autosaur" that reveals its identity?

Which of the author's remarkably logical sounding statements indicates that man is not always the master of his inventions?

Humor can be instructive as well as entertaining. Do you find an underlying truth in this playful piece of prose? What is it?

Do you think the humor is enhanced by the fact that the story sounds possible and believable?

Which of the following conclusions do you think the author intended the reader to arrive at?

We should more carefully protect our endangered species.
Automobiles kill a great many people.
The gasoline shortage, in the long run, will be beneficial to mankind and his environment.

Does there seem to be any advantage in occasionally using a light, humorous touch, such as the author employed here, when you want to make a point? Why?

PURPOSE: To become more aware of future problems and possible solutions.

LEVEL: 4-6
7-9

SUBJECT: Language Arts

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Environmental Education K-8 Curriculum, West Salem Elementary School, West Salem, Wisconsin.

ACTIVITY: Ask each child to write a short story on "How I Think My City, Town, or Home Will be Changed by the Time I Am 25 Years Old."

Have children who are willing read their stories to classmates and record on the chalkboard after each story whether the author anticipated changes in heating, transportation, food, land usage or other areas. After several stories have been read identify the most frequently cited areas of likely change. Why did they select these areas? What might happen to make their predictions incorrect? Are they happy about the anticipated changes? Why or why not? If they are unhappy,what, if anything, can they or their parents do about it?

PURPOSE: To examine personal attitudes toward pollution.

LEVEL: 4-6

SUBJECT: Language Arts
Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-12 Eco-Community Relationships - effects of humans on ecosystems

REFERENCE: Multi-Disciplinary Environmental Education Activities, Florida State Department of Education, Tallahassee. David E. Lahart and Richard C. Tillis, Editors, 1974.

ACTIVITY: Ask pupils to write their personal responses to sentence stubs such as those listed below. After completing these ask pupils to get in groups of four or five and exchange the answers they produced. After 10-15 minutes of discussion ask each group to report to the entire class the agreement (if any) that was found. Ask also what their opinions suggest about the importance of pollution now and in the future.

1. I would rather have a little pollution than . . . .
2. Pollution laws are . . . .
3. Agencies which are concerned about pollution ought to . .
4. If one environmental problem can be corrected, I'd choose . . . .
5. Most people feel that pollution . . . .
6. My biggest contribution to pollution is my . . . .

PURPOSE: To help students examine more carefully the environmental characteristics of the city in which they live.

LEVEL: 4-6
7-9

SUBJECT: Language Arts
Social Studies

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Environment and Society - People and Cities. The University of the State of New York, The State Education Department, Bureau of Continuing Education Curriculum Development, Albany, New York 12224, 1974.

ACTIVITY: During a social studies unit devoted to understanding more about the city in which they live the children can understand that cities are paradoxical. Examples can be found to show that their city is a wonderful, beautiful, stimulating and sophisticated place. It is likely to offer museums, libraries, universities, art galleries, hospitals, theaters, concerts, exotic shops, big league sports and other attractions.

On the other hand the children will learn that in some ways or places their city is horrible, ugly, and deadening to some of its inhabitants. The city has a crime problem, squalor, poverty, and disease. Hatred and despair can be found in some neighborhoods and depicted in graffiti.

As a summary activity for the unit study have each student write a letter that could be sent to someone they know or to a fictitious person who is considering moving to his city. In the letter he should describe both the good and bad features of his city with specific information about available housing, job opportunities, cultural and recreational opportunities, safety, and other items studied in the unit. The letter should point toward making a recommendation that the prospective migrant should or should not come to this city.

Have some (or all) of the letters read to the class. Do class members think this is a good place to move to or a place to stay away from? Why?

PURPOSE: To demonstrate how some discarded materials can be reused with a little imagination and creativity.

LEVEL: K-3
4-6

SUBJECT: Fine Arts

CONCEPT: II-2 The relationship between man and the natural environment are mediated by his culture.

PROBLEM: I-4 Aesthetic Considerations - litter

REFERENCE: "Art Is a Way of Living." Environmental Education Center, 13 Veterans Drive, Oteen, N. C. 28805.

ACTIVITY: Have students collect discarded cans of various sizes and shapes. With some imagination and creativity these cans may be "recycled" for different uses or given as gifts. Some possibilities are:

1. Containers - Cover or paint and decorate to hold pencils, mail and "stuff." Cover with material, decorate with braid, ball fringe, or natural objects like pine cones, burrs, acorns, and so forth.

2. Stilts - Use large juice cans. Decorate with latex paint, wallpaper, contact paper, wool, felt. Punch holes in either side of can near top edge. Run heavy twine or cord through can and tie to length desired; step on can, pull cord tight to hold cans on and walk.

3. Doorstops or Bookends - Use coffee cans or others with plastic tops. Fill cans with sand, cover with plastic tops. Decorate with felt, paint, braid, or other material.

4. Lanterns - Fill cans with water and freeze; ice will prevent cans from bending when you punch holes. Make design by punching holes with nails of varying sizes; design should be drawn on can first. Glue or screw on a bottle cap in bottom of can to hold candle. Add wire if lantern is to be hung.

PURPOSE: To affect attitudes toward water pollution through musical interpretation.

LEVEL: 4-6
7-9

SUBJECT: Fine Arts

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: I-6 Aesthetic Considerations - water quality

REFERENCE: Water Pollution. Environmental Education Curriculum, Topeka Public and Parochial Schools, Topeka, Kansas 66612.

ACTIVITY: Bring to the class a song that describes the ocean or a river or the moods these create. Such traditional songs as "Shenandoah," "Beautiful Ohio," and "On the Bank of the Wabash" may be used. Have the students learn the song and discuss the characteristics of the river that might have inspired the songwriter. Perhaps songs about local bodies of water can be found or may be written by the students. A song about a polluted river might also be effective. Many classical compositions, such as Debussy's "La Mer," may also be used in interpreting "mood" and characteristics of rivers and oceans.

PURPOSE: To use music as a means of learning about transportatio problems.

LEVEL: K-3
4-6

SUBJECT: Fine Arts
Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: I-9 Aesthetic Considerations - traffic control

REFERENCE: Environmental Education Guide - Music K-3. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Have the class make a list of songs that deal with modes of transportation. This list may include "Casey Jones," "Old Paint," "Marching to Pretoria," "Up, Up and Away," "Leaving on a Jet Plane," "Jingle Bells," "Row, Row, Row Your Boat," "Merry Oldsmobile." As several of these songs are learned and sung, discuss how modes of transportation have changed and why these changes have occurred. Arrange the songs in chronological order; does the list demonstrate how transportation modes have progressed? How did primitive modes of transportation limit the spread of population? How have changes in transportation caused changes in the environment? As new fuels were used in transportation how has the environment been affected?

PURPOSE: To become more aware of the cumulative effect of individual wants.

LEVEL: 4-6

SUBJECT: Fine Arts
Language Arts

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Environmental Education K-8 Curriculum, West Salem Elementary School, West Salem, Wisconsin.

ACTIVITY: Ask each child to cut from magazines or catalogs about 20 pictures of different things they would like to own. Have each child tell his choices to classmates and identify the things most commonly desired.

Involve the class in making a huge collage of many of the nicest pictures brought in by the children.

Develop a question such as "what would happen if everyone tried to get or actually got everything he wanted?" Ask the children to write 100 words on the question and have some of the statements read to the class. Is there any agreement on what might happen? What can they do, individually, to change what might happen?

GRADE LEVEL 7 - 9

Activities	
Science	13
Science-Mathematics	1
Science-Social Studies	4
Science-Language Arts	1
Mathematics	2
Mathematics-Science	1
Mathematics-Social Studies	1
Social Studies	23
Social Studies-Science	3
Social Studies-Language Arts	1
Social Studies-Home Economics	1
Language Arts	2
Language Arts-Social Studies	1
Fine Arts	3
Fine Arts-Language Arts	1

PURPOSE: To show the amount of top soil loss due to erosion.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: Teaching Soil and Water Conservation. Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

ACTIVITY: There are several ways of measuring the amount of soil lost due to erosion. One way is to measure the average size of a gully which has resulted from water washout (see Wheatley and Coon, 100 Teaching Activities in Environmental Education, V.I. page 144-145). Two additional techniques are presented here.

One way to see soil loss is to compare the soil profiles of a cultivated field and a pasture. Find a cultivated field where the slope has at least a 5-foot fall in 100 feet of horizontal distance. Try to find a field that has been in cultivation for some time. You can check this information about the farm with the owner or the neighbors.

Dig a small hole deep enough to get below the topsoil layer. Then cut off a slice an inch or more thick along the vertical side of the hole. Lay this slice on the ground and study it. Note the depth of the topsoil layer. Study the structure, i.e., how the particles are held together. Are they tight and does the soil hold together in large lumps (clods)? Is it crumbly like cake?

Dig another hole in the fence row at the edge of the field or just across the fence in a pasture that has not been plowed. Try to dig the second hole at about the same point on the slope and as close to the first one as possible. Study the soil layers as you did with the first sample. Lay the two samples side by side and compare them. Compare the depth of the topsoil layer and the structure of the soil.

A second technique to demonstrate soil loss is the size of a gully as it enlarges over a period of time. Find a gully that is cutting deeper and further into the field with each rain. Drive wooden pegs 10 to 15 feet about the gully head and on each side of the fully. After each rain, measure from each stake to the nearest edge of the gully to see how much the gully has grown. Do this after several rains and compare your measurements to see how much the gully has grown since you first set the stakes. By measuring the width, depth, and length of the gully, figure out how many cubic feet of soil have been lost.

PURPOSE: To make students aware of the large number of energy-using items which are found in the home.

LEVEL: 4-
7-

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-4 Eco-Community Relationships - energy production

REFERENCE: Energy. Environmental Education Project, Topeka Public and Parochial Schools, Topeka, Kansas 66612.

ACTIVITY: A large amount of energy is used in our homes to make us more comfortable, for recreation, and to make our work easier. To increase student awareness of home uses of energy have each student take home and complete the "Home Use of Energy Check List." Students, with their parents' assistance, if desired, can complete the check list. Explain that you do not want names on the sheet. This should help set a more realistic answer on some of the questions. To help the students understand the sheet, fill one out using the school as the home having all students work together. This would be a good time to have your students tour the parts of their school that they do not normally visit. The rankings will vary with each person's opinion. Reasons for rankings could lead to a very interesting and worthwhile discussion after the check list is completed.

The "Home Use of Energy Check List" should include as many home items that use energy as possible. For each item present, the student may indicate (if possible) the number present in the home, amount of energy required (many items list their wattage or BTU's; this will be important in determining the biggest energy users), type of energy going into the item (e.g., gas, electricity, battery, man's energy), type of energy being used in the end (e.g., heat, light, motion), and number of hours used per week. These questions can be arranged along the horizontal top of a chart with the list of home items forming the vertical left border. Make the list of home items as extensive as possible; some you may include are:

electric radio
portable radio
can opener (electric)
can opener (manual)
stove
refrigerator
dishwasher
toaster
telephone
hand saw
grill
clock
record player
candles
broom
fan
mop
electric razor

lamps	fireplace
television	toothbrush
pencil sharpener	flashlight
hair dryer	knife
doorbell	garbage disposal
water heater	car

After check lists are completed use them to discuss the following: (1) How is energy used in our homes? (2) In what form(s) is energy entering your home? (3) What form is the energy changed into within the home? (4) What uses in the home consume the most energy? (5) How does the home uses of energy benefit us? and (6) Which of these uses could we do without?

PURPOSE: To show the amount of residue found in polluted waters.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: I-6 Aesthetic Considerations - water quality

REFERENCE: Water Pollution. Environmental Education Curriculum, Topeka Public and Parochial Schools, Topeka, Kansas 66617.

ACTIVITY: Have students collect samples of water from different places; streams, ponds, puddles and gutters are good sources for collecting. Shake up the samples and place a teaspoon of each in a separate dish. Let the sample evaporate. After the water evaporates, there will probably be a residue of some sort in each dish.

Examine the residue carefully and discuss questions such as the following:

How did the residue get there?
Is the residue harmful?
How can the residue be prevented from entering the water?
How can the residue be removed from the water?
How can be residue in the water be made harmless?

Which way is easiest for rendering the water safe from the residue? Which way is the least expensive? Which ways are currently used?

PURPOSE: To show particulate contamination of the air.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-10 Eco-Community Relationships - effects of air quality on ecosystem

REFERENCE: Teachers Curriculum Guide for Field Ecology. Center for Environmental Education, 705 Avocado Avenue, Cocoa, Florida.

ACTIVITY: Obtain several glass or plastic jars from the school cafeteria. Wash the jars thoroughly and rinse twice with distilled water.

Place approximately 4" of distilled water in the jars and set the jar outside to collect particulate matter from the air. Locate the jars in an open area, several feet above ground level to prevent material being blown in from the surface. Leave the jars in place for 30 days; add distilled water from time to time to keep the jars from drying out.

After the sampling period, bring the jars inside. Obtain several evaporating dishes and weigh them. Place the water from the jars in the evaporating dishes. Wash the jars with distilled water; add the wash water to the evaporating dishes. Evaporate the water slowly. When the water is gone, weigh the evaporating dishes again. Subtract the first weight from the second; this will be the weight of the particulate matter from the air.

Compare the result from different areas with respect to temperature, wind direction, industrial locations, rainfall, and other climatic conditions.

PURPOSE: To trace the flow of water from the faucet to its source emphasizing man's dependency upon the continuous recycling of many substances.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Turn on a water faucet in the classroom, in the hall or on the school grounds and permit the water to flow into the drain. After a short time of observing the water flow, ask the students "Where does this water come from?"

Trace the water flow through the hydrologic cycle including steps such as: School and community water supply; water treatment plant; river, well or reservoir; underground aquifers; evaporation and transpiration; condensation and precipitation.

Discuss ways that water may be polluted on its way to the faucet such as: Biological wastes from organisms in water; dirt, dust, erosion, and sediments; fallen material - leaves, branches, tin cans; agricultural losses - erosion, fertilizers, insecticides, animal wastes; industrial wastes - chemical and thermal pollution; community wastes - sewage, storm water, household products.

PURPOSE: To show the transformation of energy from one form to another in an energy chain.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: IV-1 Organisms and Environments are in constant change.

PROBLEM: IV-4 Eco-Community Relationships - energy production

REFERENCE: Energy and You. Environmental Education Curriculum, Topeka Public and Parochial Schools, Topeka, Kansas 66617.

ACTIVITY: This activity can be used to motivate the students into tracing power (movement of air) back to its original energy source (the sun) and speculating on further uses of this mechanical energy.

Have the students construct several pinwheels from construction paper, a straight pin and a small stick (pencil). Using a breeze from a window or door opening, demonstrate the production of mechanical energy. Since energy cannot be created or destroyed, let the students trace the energy pathway backwards as far as they can. We usually regard the sun as the ultimate energy source, but is the sun "creating" energy or just changing its form?

The rotating pinwheel is mechanical energy. In what ways can this energy form now be used. Let the students use their imaginations. Can a house be supplied with all its energy from a giant pinwheel? (Such houses are actually in operation on an experimental basis.) What are some problems involved with wind energy?

PURPOSE: To enable pupils to understand that noise affects rate of heartbeat.

LEVEL: 4-6
7-9

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: I-5 Aesthetic Considerations - noise

REFERENCE: Sounds and Noises. Thomas L. Chapman, Madison County ESEA, Title III Project, Environmental Education Center, Oteen, North Carolina 28805.

ACTIVITY: Review with the class the procedure for determining rate of heartbeat by taking pulse rate at the wrist or at the throat. When each child is able to count his pulse rate use a stop watch or wristwatch with sweep second hand and ask each child to count his heartbeats for 30 seconds. Ask each child to calculate his heartbeat rate for one minute and record the number for future use.

Review with the class some of the things that make their hearts beat faster such as running, excitement, and fear. If not mentioned by a child,the teacher can suggest the possibility that noise may also be an influencing factor. (Previously the teacher should have selected three pupils and planned with them as to how they could go to the rear of the room and make noise by dropping a heavy book repeatedly, pounding on a tin pan, or using other loud sound-making devices.)

Indicate that each pupil should count his heartbeats again when considerable noise will be made in the classroom and follow the procedure used to get the initial "normal" rate per minute.

Ask each pupil to indicate increased, no change, or decreased beats per minute during the noisy time. If (as is likely) a sizeable percentage of the pupils have increased rates,what does this mean? What physical or mental conditions other than heartrate are sometimes affected by noise? What types of workers are particulary vulnerable to loud noises? Can/should anything be done to protect these workers and people generally from too much noise?

PURPOSE: To develop an awareness of the use of pesticides in the environment.

LEVEL: 7-9

SUBJECT: Science

CONCEPT: IV-2 The rate of change in an environment may exceed the rate of organism adaptation.

PROBLEM: II-5 Health Considerations - food quality

REFERENCE: "DDT in the Food Chain." Environmental Education Center, 13 Veterans Drive, Oteen, N. C. 28805.

ACTIVITY: Introduce this topic by bringing to class several home products that contain pesticides, such as flea collars, shelfpaper, insect repellent, mothballs, and household sprays. As the students examine the products, ask the following questions: What is the name of the product? Notice how the trade name emphasizes "kill power." What are the ingredients? How do they kill their victim? Are they harmful to humans or household pets? Is there a warning on the container. Is there an antidote for the poison in the container? Do the containers contain conflicting information?

Over the weekend, have the students find other poison-containing products in the home.

Because pesticides may be harmful to animals, it is easy to suggest that their use be totally banned. However we need to consider what would happen if all such products were forbidden.

Invite a farmer to discuss this point in class. Would crop production decrease? Would the cost of farm products increase? Would farmers still be able to remain in business?

PURPOSE: To identify pollen as a natural air pollutant.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: II-3 Health Considerations - air quality

REFERENCE: Air Pollution Experiments for Junior and Senior High School Science Classes. Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

ACTIVITY: Ragweed pollen is a natural pollutant to which many people are allergic. During late August and early September, large quantities of ragweed pollen are released into the air; the pollen release occurs early in the morning as the rising sun dries the pollen sacs and causes them to burst. Most of the released pollen settles to the ground after being airborne for about 200 feet. This activity provides a method for collecting and counting the pollen. To collect the pollen, obtain a clear glass slide and cover one side with a smooth, very thin film of grease; silicone stopcock grease or its equivalent is a good type to use. Use a wax pencil to mark the greased side of the slide with an X; take care not to touch or smear the greased surface. Collect your sample on the roof of a 2 or 3 story building, well away from any structures that might affect the free movement of air; the sample should be 30" higher than any railing or wall on the roof. A Durham sampler may be built to hold the slide or the slide can be held by clothespins attached to a wooden frame; the slide should be situated so that its long axis is parallel to the prevailing wind direction. Begin each sample early in the morning (8:00 a.m.) and continue for 24 hours. Ragweed pollen can be counted directly from the greased slide with a 100X microscope. Under this magnification the ragweed pollen grains would look like small straw-colored golf balls. Determine a 2 sq. centimeter area (2.0 cm x 1.0 cm) for counting; divide the results by two in order to obtain an average number of pollen grains/cm^2. The counting area can be marked off with tape and a wax pencil on the non-greased side of the slide; a Whipple disc for the microscope eye-piece would be useful in providing a background of cross section lines to aid in counting.

PURPOSE: To learn how environmental factors control the species of organisms that occur in a particular ecosystem; to study an aquatic ecosystem.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: IV-7 Eco-Community Relationships - species control (non-human)

REFERENCE: "Teaching Materials for Environmental Education" Forest Service, U.S. Department of Agriculture.

ACTIVITY: This activity should follow a study of a stream or pond environment where the students have observed and identified the aquatic organisms. It is the chemical and physical characteristics of the water which determine which species of organism is present; consequently by knowing which organisms are present, students should be able to predict the characteristics of the water.

Using the tables given on the next page, each student should be able to complete the following predictions:

I predict:

The water temperature will be _____because_____.
The air temperature will be _____because_____.
The water pH will be _____because_____.
The dissolved oxygen (D.O.) in the water will be _____ because _____.

After having made and justified their predictions, the students should verify the actual values of the water characteristics by using one of the commercially available water testing kits.

pH RANGES THAT SUPPORT AQUATIC LIFE

	MOST ACID → MOST ALKALINE													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bacteria	1.0												13.0	
Plants (algae, rooted, etc.)						6.5						12.0		
Carp, suckers, catfish, some insects						6.0			9.0					
Bass, crappie						6.5		8.5						
Snails, clams, mussels							7.0		9.0					
Largest variety of animals (trout, mayfly, stonefly, caddisfly)						6.5	7.5							

DISSOLVED OXYGEN REQUIREMENTS FOR NATIVE FISH AND OTHER AQUATIC LIFE
(D.O. in parts per million)

Cold-Water Organisms including (salmon and trout) (below 68°)
- Spawning ..... 7 ppm and above
- Growth and well-being ..... 6 ppm and above

Warm-Water Organisms (including game fish such as bass, crappie) (above 68°)
- Growth and well-being ..... 5 ppm and above

TEMPERATURE RANGES (APPROXIMATE) REQUIRED FOR GROWTH OF CERTAIN ORGANISMS

Temperature		Examples of life
Greater than 68° (warm water)		Much plant life, many fish diseases. Most bass, crappie, bluegill, carp, catfish, caddisfly.
Less than 68° (cold water)	Upper range (55-68°)	Some plant life, some fish diseases. Salmon, trout, stonefly, mayfly, caddisfly, water beetles, striders
	Lower range (Less than 55°)	Trout, caddisfly, stonefly, mayfly

PURPOSE: To develop an awareness of environmental advertising.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Have the students keep a record or log of television commercials, newspaper and magazine ads that relate to the environment; pay particular attention to ads for products which might contribute to pollution problems. Try to determine if the advertising in any way reflects a growing concern on the part of the businesses for prevention of further environmental degradation. Also notable would be any commercials which seem to be directed toward helping the public better understand some of the problems and hazards involved in using many products, such as detergents and pesticides.

Carefully study ads which are suspect. Are quoted statistics correct? Are all factors adequately considered? If the ad states that the company pollutes "less," does it state "less" than what? How are pictures of pristine environments used to influence the attitudes of the viewers?

Display ads which are brought to class. Point out legitimate uses of advertising, as well as the ads with the "catches."

How influential are environmental advertisements? A survey of students in the school on their responses to displayed ads might be helpful.

PURPOSE: To study the effects of air pollution on vegetation.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-10 Eco-Community Relationships - effects of air quality on ecosystem

REFERENCE: Air Pollution Experiments for Junior and Senior High School Science Classes. Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

ACTIVITY: Sulfur dioxide is one of our most abundant gaseous air pollutants since it is a product of the combustion of most fuels. Certain strains of white pine (Pinus strobus) are particularly susceptible to very low concentration of sulfur dioxide in the air. The first noticeable change in the pine due to sulfur dioxide is a characteristic banding on the needles; several minute bands--each with a yellow-brown-yellow color arrangement--will occur on the needles accompanied by a slight swelling (usually only visible with a microscope) at each band.

Once affected trees are identified, various studies can be conducted by the class. Tagged trees can be observed and records kept over long periods of time to note changes in the tree; comparisons with healthy trees would be important. Affected needles usually fall in the winter rather than remaining on the tree; needle growth is often noticeably stunted.

Microscopic studies of needle surface and cross-sections and longitudinal sections can be made. Other strains of white pine seem to be susceptible to other air pollutants. Some consideration is being given to the use of pines in detecting and quantifying air pollution.

PURPOSE: To demonstrate the effects of air pollution on material in clothing.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-10 Eco-Community Relationships - effects of air quality on ecosystem

REFERENCE: Air Pollution Experiments for Junior and Senior High School Science Classes. Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

ACTIVITY: Material from good quality nylon hose should be mounted in small frames, such as the standard Polaroid slide mount (#633, 3 1/4 x 4") or similar size wooden frames. Cut squares of material from the hose and mount on the frame; prepare several samples. Place the mounted nylon in a safe place on the school roof; support the frames in a horizontal position so that air can pass through the material from both sides. Expose the nylon to the air for various lengths of time from 30 to 90 days; examine the samples at the end of exposure, keeping careful records of the number of broken threads. With careful planning in setting out the samples, the end of the various periods of exposure could occur all on the same day; this would allow for direct comparisons of samples. An easy, quick way to examine the nylon samples is project the mounted sample on a screen with a slide projector.

Discuss the various types of air pollution which may be causing the destruction of the nylon: sulfuric acid in soot particles, hot particles in smoke, acid aerosols, nitrogen oxides, phenolic particles and aldehydes, and solvent vapors and droplets.

PURPOSE: To measure the steepness of a slope.

LEVEL: ~~4-6~~
7-9

SUBJECT: Science
Mathematics

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: "Conservation Activities for Girl Scouts." Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

ACTIVITY: Slope is an important factor in determining proper land use. It often decides whether a piece of land should be used for grass, trees or cultivated crops. It is also a consideration when selecting sites for homes, highways, sanitary landfills, parks, or other uses.

Length and steepness of slope, together with the type of soil and the kind and amount of vegetation, affect the speed of runoff and the amount of erosion. The steeper the slope, the faster will be the flow of water and the greater the amount of soil that can be carried with it. The longer the slope, the more chance runoff can pick up speed and move increasing amounts of soil.

To measure the steepness of slope you will need a yardstick, straight stick exactly 50 inches long, and a carpenter's level or a flat bottle half full of colored water. If you use a bottle, lay it on its side on a level surface; with a pencil or a piece of tape, mark a straight line along its side following the top of the water level.

Select the site where you want to determine the slope. Place the 50 inch stick on the ground running in the direction of the slope. Place the carpenter's level or the bottle on the stick and raise the lower end of the stick until the stick is level as indicated by the bottle or level. With the yardstick measure the distance from the bottom of the stick to the ground in inches. This figure drops over a distance of 50 inches. If you multiply the figure by 2, you will get the percentage of slope.

PURPOSE: To measure personal use of water in the home.

LEVEL: 4-6
7-9

SUBJECT: Science
Social Studies

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Interdisciplinary Concepts and Activities - Grade 4. Environmental Education Center, Lee County Schools, Fort Myers, Florida.

ACTIVITY: Before indoor plumbing and water was piped into our homes, people used an average of 4 to 5 gallons of water per day. Today the average American uses 60 gallons of water per day. Much of this is water that is wasted simply because the supply is readily available.

Have each student determine how much water he uses each day for a week by using the following chart:

How Much Water I Use in the Bathroom

Use of Water	Amount of Water Used	Number of times done						
		S	M	T	W	T	F	S
Washing hands in sink	Cups							
Washing face in sink	Cups							
Brushing teeth	Cups							
Drinking water	Cups							
Taking bath	Gallons							
Taking shower	Gallons							
Flushing toilet	Gallons							
Total Number of Gallons Each Day								
Total Number of Gallons One Week								

Now the student needs to determine how much water he uses each time he performs one of these tasks. This can be done in the following manner:

Put a stopper in the sink. Using a measuring cup fill the sink one cup at a time. Each time a cup of water is added, mark the level of the water on the side of the sink with a pencil. (The pencil marks can be washed off when the

experiment's over.) Empty the sink, and put the stopper back in place. Now wash your hands as you normally do. What is the water level in the sink? How many cups of water did you use? Write this amount on your chart. Repeat the same process with washing your face and brushing your teeth.

To determine the amount of drinking water, measure the number of cups of water your bathroom glass holds. Mark this on your chart.

To find how much water you use to bathe, take a bath and mark the level of the water in pencil. Next, stopper the tub and take a shower; mark this water level. Empty the tub to the "shower" and "bath" levels; enter the number of gallons for each on your chart.

To measure the amount of water in your toilet you will need the help of a friend. Take the top off the toilet tank. Have a friend hold the float in position while you dip the water out of the tank and measure the number of gallons. This water is clean so don't worry about it. Enter the measurement on the chart.

Each student should keep track of his water uses for a week. Determine how much water is used. How much water would you save if you took only showers instead of a bath? Is it necessary to use so much water in flushing the toilet? You can reduce the capacity of your toilet tank by putting a brick in the tank; this would take the place of approximately 2 pints of water (1/4 gallon). How much water would this save in a week?

Are there other ways to save water?

PURPOSE: To become more aware of the critical importance of petroleum and natural gas.

LEVEL: 7-9
10-12

SUBJECT: Science
Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: As a homework assignment ask students to find the names of at least ten chemical substances that are made completely, or partially, from the basic resources of petroleum and/or natural gas. Urge them to go far beyond common substances such as gasoline and other petroleum distillates to plastics, fibers, drugs, fertilizers, pesticides and other organic compounds synthesized from hydrocarbon compounds.

Develop on the chalkboard a list of at least 50 substances they have found to come from hydrocarbon sources. Discuss the importance of these substances in the lives of individuals or the economic welfare of a country.

Discuss the idea that petroleum is much too important a substance to burn for heat when it appears to be so irreplaceable for future generations as a basic ingredient in organic chemistry.

Is it necessary and/or desirable for the modern technological world, particularly the United States, to change its life style to conserve more of this resource?

PURPOSE: To provide a mechanism for establishing priorities.

LEVEL: 7-9
10-12

SUBJECT: Science
Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Environmental Science Study Project. Where the Action Is. P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: During most considerations of environmental concerns, there comes a time when the students must establish some order of priority from a list of values, criteria, problems, etc. Pair weighing is one method for doing this. Let's suppose the following criteria have been listed by the students as important factors in considering what activities to do as a class:

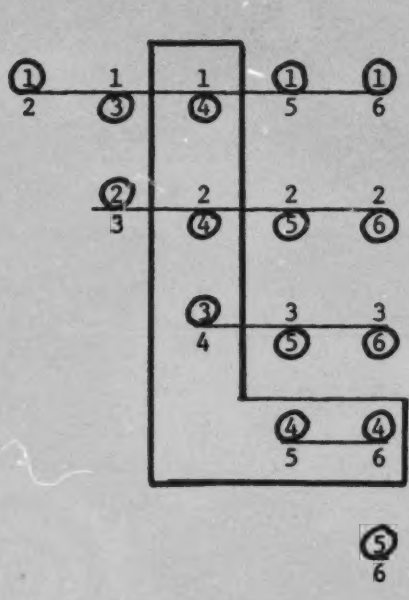
1. Fun and interesting activity
2. Does not involve time outside school
3. Gives experience in new area
4. Helps the community
5. Does not take much money
6. Does not take students out of classes

This list is not in order of importance; the numbers are assigned only for convenience.

Now each student pair-weighs each item. He decides which one criterion is most important to him for the pairing No. 1 (Fun and interesting activity) with No. 2 (Does not involve time outside school); then he compares #1 with #3, #1 with #4, #1 with #5, and #1 with #6. This can easily be done by a teacher reading out loud the two criteria being compared and the students responding without dwelling on the weighings. Each student should record his responses on the form by circling his preferred choice.

①	1	1	①	①	#1 =
2	③	④	5	6	

The same procedure is followed in comparing criterion #2 with with #3, #4, #5, and #6; criterion #2 was already compared with #1 in the preceding step. If the form shown below is used, the results are easily tabulated.



Each student's chart should look like the one above (with different choices, of course). To tabulate the number of times criterion #1 was chosen simply count the number of circled "1's" horizontally across the first line; in this case, #1 received 3 favorable pair-weighings.

When tabulating the pair weighings for criteria 2-6, both horizontal and vertical readings must be made. For example, to tabulate the pair-weighings of criterion #4 (above chart) the students must read down the vertical column when #4 was compared with #1, #2 and #3 and then read horizontally where #4 was compared with #5 and #6; in this case the number of favorable pair-weighings for criterion #4 is four.

Each student should now have pair-weighing totals for each of the six criteria. The student totals for each criterion should be added together and a class average obtained. From the pair-weighing averages a priority listing of the criteria can be arranged with the criterion having the highest pair-weighing average being the first priority. The same procedure is followed whenever a priority listing is necessary.

PURPOSE: To become aware of dangers related to aerosol gases and to assess public concern about this problem.

LEVEL: 7-9
10-12

SUBJECT: Science
Social Studies

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: III-2 Genetic Considerations - chemicals (air, water, food)

ACTIVITY: Ask two or three students to do library research on the affect of fluorocarbon gases such as Freons, used as propellants in aerosol cans, on the stratospheric ozone layer. Ask that the students report to their classmates on such things as (1) the quantity of such gases released into the air annually, (2) the chemical reactions that result in a depletion of the ozone layer, (3) the importance of the ozone layer as a radiation shield and (4) the relationship between intensity of radiation from the sun and the incidence of skin cancer.

Devise with the class a small number of questions to be used with parents or other adults to (1) determine if they are aware of the problem (2) their assessment of the seriousness of the problem and (3) their ideas about what, if anything, should be done about it.

Ask each student to report to the class the responses he got to the questions. Summarize the findings. What, if anything, do the responses suggest regarding a lack of communication among scientists, aerosol can manufacturers, the lay public, and government regulatory agencies?

PURPOSE: To facilitate awareness of environmental concerns and to demonstrate the use of non-verbal communication.

LEVEL: 4-6
7-9

SUBJECT: Science
Language Arts

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I Aesthetic Considerations
IV Eco-Community Relationships

REFERENCE: Environmental Science Study Project. Man and His Environment. P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: Before class write on separate strips of paper the following phrases: you are litter on the highways; you are a fish dying from lack of oxygen; you are human sewage polluting a river; you are a fish filled with poison such as mercury; you are an automobile with a very dirty, poisonous exhaust; you are a litterbug; you are the last living member of a species; you are a harmful pesticide. (The teacher may want to supplement or alter these.)

Divide the class into small groups of 3 or 4 students. A random method (such as "counting off") might be used so that the students will be grouped with other students they may not be acquainted with.

Explain that each group will become whatever is written on their strip of paper. All have to do with environmental problems caused by man. They will be given five minutes to develop a pantomine that will enable the rest of the students to guess what they are. The students can do anything but talk.

When five minutes have elapsed, let each group present its charade. You may want to time how long it takes for the class to guess each identity.

Ask the students if they found it difficult to communicate their ideas without being able to talk and listen. Point out the need for sharpening their other senses if they want to be environmentalists. Ask them why this is necessary. They should realize that environmental problems are usually seen or smelled. A dead fish or poisonous exhaust won't shout its presence!

PURPOSE: To use graphs to illustrate home water use.

LEVEL: 7-9

SUBJECT: Mathematics

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Environmental Education Guide - Mathematics. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: The average American uses 60 gallons of water each day in the home. This water usage can be broken down in approximately the following manner:

Flushing toilet	24.5 gal.
Washing and Bathing	22.0 gal.
Kitchen use	3.5 gal.
Drinking	3.0 gal.
Washing Clothes	2.5 gal.
Watering	2.0 gal.
General Cleaning	2.0 gal.
Washing Cars	0.5 gal.
	60.0 gal.

What would be the best way to graph this data in order to show water usage. Try several types of graphs and then decide which gives the proper impression.

Line graph
Bar graph
Circle ("pie") graph
For the circle graph is it necessary to change the data to another form?

From the graphs it is obvious that flushing toilets and bathing are the major functions which use water. What can be done to reduce the amount of water used in these two areas?

Toilets - Many countries have flush toilets with a much smaller water capacity than American toilets. How would a vacuum toilet work?

Bathing - Which uses less water - a shower or a bath? How could you find out?

PURPOSE: To consider environmental matters while developing mathematical skills.

LEVEL: 7-9
10-12

SUBJECT: Mathematics

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Environmental Education Guide (General Math 9-12) Project I-C-E (Instruction-Curriculum-Environment) 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Mathematics teachers can find or develop problems such as the following that provides practice in basic mathematics skills while focusing on real environmental matters. Practice to develop skills (calculations) can be enlivened by student discussion on the relevance of the examples to their present and future living. The reference cited above includes many worksheets similar to the one below.

1. Research has shown that the average individual, during his lifetime, uses the following:

   3,000,000 gallons of water
   20,000 gallons of gasoline and creates
   46 tons of garbage.

   A. Expand this total to a family of six.
   B. Expand this total to the population of a community of 100,000.
   C. Expand this total to the population of a state of 4 million.

2. The garbage output averages 6 pounds per day per person. (This includes all output of garbage from all sources.) How much garbage from all sources will a city of 50,000 put out in a week? How many tons is this? If an incinerator can burn 5 tons per hour, how many hours will it take to dispose of one week's garbage?

3. At the time of takeoff, a four-engine jet pours out 88 pounds of air pollutants. If such a plane takes off every minute from an airport, how many pounds of pollutants are poured out into the air in 1 hour? In 1 day? In 1 week? In 1 month (30 days)? In 1 year? Convert all of these answers to tons.

PURPOSE: To become aware of the enormous energy used in the United States to produce "throw-away" glass containers.

LEVEL: 4-6
7-9

SUBJECT: Mathematics
Science

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: Ask students to save for one week all "throw-away" glass containers that normally go into their trash or garbage cans at home. Ask that they weigh the collection and report the weight to the class. From the sample of responses have students calculate the total weight of glass thrown away by all of the families represented in the class during a week, month, and year.

Secure from a glass manufacturing company an estimate of the number of cubic feet of natural gas needed to produce a ton of glass bottles. Have students calculate the cubic feet of gas used to produce the thrown away bottles per week, month, and year. Compare the amount used to produce a month's supply of throw aways with the amount used to heat an average home (or better still, their own, if gas is used) per month.

Should we reduce our use of throw away bottles to save energy? Why? Why not? Who would be hurt? Who would be helped? What, if anything, do students plan to do about this matter?

PURPOSE: To become aware of growth rate differentials among selected countries.

LEVEL: 7-9

SUBJECT: Mathematics
Social Studies

CONCEPT: III-2 Family planning and the limiting of family also are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.

PROBLEM: IV-6 Eco-Community Relationships - population studies

REFERENCE: "Interchange" Population Education Newsletter, July 1974.

ACTIVITY: Review with the class the following formulae:

The birth rate is the ratio of all births to the total population, in a specific year, multiplied by 1,000.

$$\text{Birth Rate} = \frac{\text{Number of births per year}}{\text{Population}} \times 1{,}000$$

The death rate is the ratio of all deaths to the total population, in a specific year, multiplied by 1,000.

$$\text{Death Rate} = \frac{\text{Number of deaths per year}}{\text{Population}} \times 1{,}000$$

The growth rate is the ratio of the difference between the births and deaths plus the difference between the number of immigrants and emigrants to the total population, in a specific year, multiplied by 1,000. The result is divided by 10 to obtain the rate as a percent.

$$\text{Growth Rate} = \frac{(\text{births} - \text{deaths}) + (\text{immigrants} - \text{emigrants})}{\frac{\text{Population}}{10}} \times 1{,}000$$

Doubling time is the number of years needed to double the original population size; this depends on a country's rate of population growth. If the growth rate were to remain constant, the following doubling times could be expected:

	Population Growth Rate	Doubling Time
Switzerland	1%	70 years
Cameroon	2%	35 years
Cambodia	3%	23 years

(To estimate doubling time, divide the number 70 by the growth rate.)

Ask the students to work in pairs to calculate birth rates, death rates, growth rates, and doubling time for selected countries such as those cited below. After agreeing on data calculation engage the class in discussing what growth rate means to natural resource use, pressure on land, and standard of living. Is high growth rate a bigger problem for an industrialized or developing country? Why? Do industrialized countries have high or low birth rates? Why?

1973 - Demographic Data for Seven Countries

	Number of births/yr	Number of deaths/yr	Total population
Colombia	1,066,500	260,700	23,700,000
Chile	270,400	93,600	10,400,000
India	25,216,800	10,206,800	600,400,000
Japan	2,038,700	751,100	107,300,000
Tanzania	672,100	314,600	14,300,000
Sweden	113,160	85,280	8,200,000
United States	3,280,680	1,976,820	210,300,000

PURPOSE: To have students experience a situation of crowding.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: III-2 Family planning and the limiting of family also are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.

PROBLEM: IV-6 Eco-Community Relationships - population studies

REFERENCE: Environmental Learning Experiences for Grades Three and Four. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: In this activity, students will be placed in a situation where they must work under crowded conditions. This must be in conjunction with another teacher and her class. Both groups will be put to work in their respective room doing some project that does not require direct teacher supervision. This project should involve students working individually or in small groups; they should be using equipment and facilities that are in the room, such as special paper, chalkboard, table space, etc. (The project may be, for example, to construct a collage related to an environmental problem.)

After the students have been working for a short while in their separate classrooms, merge the two classes. Place both classes in one of the two classrooms. Have the students continue working on their projects; do not increase the facilities, equipment, or supplies.

The students will soon react to the frustrations of running out of supplies, not having enough space, too much noise, too many distractions. Some arguments may occur. Break these up, but make sure the students notice these have occurred. The noise level in the room will increase; allow this to happen unless it disturbs other people in the building. After the effects of crowding have become noticeable, separate the two classes into their original classrooms. In a discussion, make the point of some of the results of crowded conditions: noise, anger, lack of supplies, reduced space, and other factors that bothered them. This may be a good time to introduce data on population growth and speculate on whether or not the earth is becoming too crowded.

PURPOSE: To examine the importance of transportation in American life.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Living Within Our Means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Mobility has always been a prominent characteristic of the American way of life. Discuss or have children chronicle this feature of our way of life which might be summarized by the phrase, "America - A Nation on Wheels."

What does the phrase mean? What industries, jobs, and activities are directly related to the various transportation industries? How are your lives and your parents' lives dependent on these forms of transportation?

Continue the discussion and divide the class into four groups, assigning each group one of the following categories of transportation as a research assignment: Cars/Trucks/Planes/Trains. The following questions might be helpful in guiding this phase of the activity:

How many people own, operate, or use a mode of transportation?

What natural resources are essential to production in, and the operation of, your industry?

How does either a decrease in supply or demand affect your industry?

How does increased demand coupled with decreased supply affect price and availability to consumers?

What effect has your industry had on the environment? What problems need to be solved?

What government practices have been initiated or have been proposed with regard to your industry? Why?

How responsive has your industry been to public demand for environmental protection?

What is your industry doing to better serve the public as well as its own interests?

As the class shares the data gathered in the form of reports, charts, pictures, statistics, and the like, have the pupils decide:

-what priorities should these industries have
-whether or not the public interest and the environment have or have not been adequately considered by these industries in the past
-what actions should be taken in the future to safeguard the general welfare (public and private)

PURPOSE: To understand the increasing complexity of urban life.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "City Planning" by Mary Beth Durner for Environmental Education Center, 13 Veterans Drive, Oteen, North Carolina 28805.

ACTIVITY: The class can work together or in groups in discussing the needs of a community 200 years ago and the needs of a city today. Needs such as water, food, clothing, shelter, tools, weapons, transportation, power, government, and recreation might be identified for a pioneer community. Students should attempt to indicate what was required from people or from the environment to meet those needs in a community 200 years ago.

A similar list of needs with few additions (such as communication systems) can be developed for a present day city. Students should attempt to indicate what is required from people or the environment to meet the needs of people living in cities today.

Students, working in small groups, might draw a map of a pioneer community and show sources of food, water, manufactured goods, etc. In a simplified manner a map of a large city might be drawn showing sources of food, water, manufactured goods and services.

Subsequent discussion might focus on the major differences between early basically self-sufficient communities and present inter-dependent communities. In what respects have the changes been good or bad?

PURPOSE: To demonstrate the dependency that all countries have on each other and show the earth as an integrated environment.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Environmental Education." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Assign students the task of listing 10 major imports and 10 major exports for each of several countries including the United States. The information obtained should then be featured in chart form showing the sources of all these traded products. These interrelationships can be illustrated by using a world map and connecting the trading nations with thumb tacks and colored string.

Discuss the diverse nature of the goods traded and their importance to the nations which buy them. Consider questions such as the following:

Why do countries import goods?
What responsibilities do nations have to each other in international trade?
What could a country do if certain raw materials or manufactured goods were no longer available from other countries?
Are raw materials equally distributed around the world?

PURPOSE: To develop an awareness of noise pollution and its sources.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human population, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: I-5 Aesthetic Considerations - noise

REFERENCE: Environmental Learning Experiences for Grades Five and Six. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio.

ACTIVITY: One of the first steps in making students aware of noise pollution is to have the class visit sites of various kinds of noise pollution; if field trips are not possible, then the teacher should visit such sites with a tape recorder and record the sounds at each stop making sure the volume control of the tape recorder is on the same setting at each site. Possible sites to visit are a quiet room (for comparisons), school hall when classes change, room with normal conversation, a busy traffic intersection, industrial plant, and an airport. Have students separate and identify the sources of the sounds they hear.

Noise pollution can be broadly divided into two classes - cultural "noise" and physical "noise." Cultural "noises" are those sounds that are unpleasant to hear. These sounds are often mediated by the culture in which one lives. Adults often think that teenagers' rock music is noise; a country cousin may think the quiet city nights are noisy; airplanes passing over a residential neighborhood is an out-of-place noise. What factors determine if a sound is a cultural "noise" or not? Does peer pressure have an effect on this? A school corridor between classes may be as loud as a traffic intersection but may not be considered noisy. Why?

Physical "noises" are those sounds which physically damage the human auditory system. Loud sounds deaden sensory cells in the ear; this is a function of loudness and time. A physical "noise" may not be a cultural "noise"; certain levels of sound in rock music are physically harmful. Visit an industry (or have an industry representative come into class) and find out how workers are protected from physical "noise."

PURPOSE: To study the effects of damming rivers and streams.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Study and discuss the effects of damming rivers and streams. Build a model dam in the classroom, using a stream table or a similar arrangement. If a small stream is available on school property, use it to demonstrate the effects of damming. Emphasize the following ideas during this study:

Alteration of water velocity - effect on flood control, on organisms living in the stream, on communities down stream

Alteration of water temperature - how much is the temperature affected (write to a local reservoir or take actual measurements) effect on organisms

Erosion - where will sediments collect; what is the site of accumulation; what is the "life expectancy" of a reservoir.

Uses of water impoundment - flood control - this is often a major reason for building a dam; is this reason always appropriate? Are there laws governing the building of structures on a flood plain? What other use can be made of a flood plain?

Community water supply - how does sediment affect this?

Recreation - not all reservoirs are equipped for this type of use. What are some of the problems involved with recreation on reservoirs? (Litter, water safety, damage to dam facilities, vandalizing.)

PURPOSE: To show the amount of material wasted in excess packaging.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Land Abuse - Quality Control. Environmental Science Study Curriculum, P.S. Jones Junior High School, Washington, D.C. 27887.

ACTIVITY: If possible, take the class or a committee of students to a grocery store and have the students find examples of various types of excess packaging and try to explain the purpose of such packaging. If a field trip to the store is not possible, the teacher and students could bring various packing examples to class.

Things to notice about the packaging include:

1. What are the purposes of packaging items? Which purposes are essential (e.g., protect item, prevent spoilage) and which are non-essential (e.g. attractive colors, makes item look larger)?

2. Does the color of the package make any difference? Did you ever buy a product because you liked the way it was packaged?

3. How is the packaging of an item used in advertising the item, especially television advertisement?

4. Are all items packaged? Some items won't spoil and are easy to handle without packaging; examples are spools of thread, pens, screwdrivers, hammers, etc. Yet sometimes these items are also found in "bubble packs." What are the advantages of "bubble packs?"

5. Some items are packaged in small containers for convenience. Compare the amount of cardboard packaging in a variety pack of cereal with a single large box of cereal that holds the same amount. Open each variety, pack and measure the total area of cardboard used in the single box. Which was less expensive? What are the advantages and disadvantages of "the variety pack?"

PURPOSE: To gain an understanding of the natural factors which determine the development of a land area through a simulation game.

LEVEL: 4-6
7-9

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "The Creation and Re-creation of a City." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: The students will be shown a transparency projection of a map of an island. This particular island is well endowed with various geographical zones. The teacher will point out on the map the various geographical areas and characteristics of the island. They include:

1. Swampy region
2. Mountainous region
3. Desert area
4. Riverbeds
5. Rolling hills region
6. Timberland or forest areas

The students should be divided into groups of four or five. Each group will then discuss among its members and come up with answers to the following types of questions: You are a group of settlers. Why did you come to this island? What were some of the reasons you moved from your former home? Where do you plan to settle on the island? Why? What type of economy will you have? Where will you get the necessities of life--food, clothes (if you need them), water, etc.? What type of shelters will you have? What type of transportation will you need, if any? Assuming that the other groups settled on this island in the other three corners--How will you treat your neighbors? Will you communicate with them? Trade with them? How will you decide on the borderlines or boundaries. Give your settlement a name.

The students will be asked to draw a picture portraying life in their settlement, some of the buildings, the type of work they will be doing, how they will organize their city, plans for recreational spaces, and so forth. The members of each group will be asked to choose a method of presentation of the information about their particular group settlement. After all groups have made their presentations, skits, or speeches or whatever other method they decide upon, each student will be asked to decide which city he would rather live in and give his reasons briefly. The teacher will record the number of votes each group gets and will give the results after all students have given their choices.

PURPOSE: To understand how the use of the automobile has brought about change in the downtown areas of cities.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "Downtown" Environmental Education Center, Lee County Schools, Fort Myers, Florida.

ACTIVITY: This activity examines the role that cards and traffic patterns play in determining the number of businesses and people that can be found in the downtown section of a city. The activity should be adapted to a specific locality; therefore, the activities suggested here are very general.

Visit a downtown area and study the traffic flow on a busy street. By actual count determine if more cars are turning into the street or off the street at various intersections.

Measure the width of the street. If a car needs about 7 feet of width for parking (parallel) and 10 feet for driving width, how many lanes of traffic can this street support if there is parking on both sides? On one side?

Are there many businesses which require customers to enter the store (as opposed to offices) on this street? Where do the customers park? Are there enough parking places on the street? What about the parking lot? Although parking lots provide more space for cars, they also take up space that was once used for a building or park.

Are there any vacant buildings on the street? What kinds of businesses were in these buildings? Have these businesses relocated within the city? Where? Was the movement of the business in relationship to the need for more parking facilities?

Remember as population increases so do the number of cars.

PURPOSE: To have students apply creativity to urban design.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: Environmental Science Study Project. Man and His Environment. P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: This is one of several activities from Man and His Environment which leads to the construction of a model city - Fox City. After studying what a city is and what the needs of the city are, students study how to plan a city. After the planning comes the construction and evaluation of the model city. When the students are ready to actually plan their own city, the following activity may be used:

Have each student fill out a chart for the following categories:

1. The problems I want to eliminate, and how to eliminate them. For example.

Problem	Plan
overpopulation	laws to prohibit more than two child-births per woman, birth control programs, etc.
pollution	recycling, laws to prevent, not so much industry, etc.

2. The things I value most and how to have these things. For example.

I value	How to have it
forests	restrict human population and industry, demand less goods, promote programs in planting trees, etc.
motorcycles	have a plant to make them, advertise to attract sales, gasoline stations, repair shops, etc.
family	have enough jobs, homes, schools to support families, doctors, etc.

3. The things I need and how to provide these. For example,

I need	How to provide
food	farmland, food processing plants, grocery stores, transportation, etc.
water	purification plant, pipeline source of water, etc.

The above can be done as homework and the class divided into discussion groups of 4-5 students each to exchange and supplement ideas.

If the class is to construct a model city as a group, each discussion group should present a "blueprint" of their ideas to the class and the class vote on the most appropriate plan. "Blueprints" may be altered to incorporate the best ideas and suggestions.

PURPOSE: To demonstrate the effects of overcrowding in a population.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: III-2 Family planning and the limiting of family also are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.

PROBLEM: V-1 Psychological and Behavioral Considerations - crowding

REFERENCE: Interdisciplinary Concepts and Activities - Grade 8. Environmental Education Center, Lee County Schools, Fort Myers, Florida.

ACTIVITY: Human population, like that of other organisms, will be limited by environmental controls. However, by the time the caring capacity level for humans is reached, the quality of life will be very unpleasant. Overcrowding in man leads to increased aggression. Consider the following statistics:

U.S. Population	1960	1970
	179.3 million	203.2 million

U.S. Crime Rate for Violent Crime Known to Police/100,000 Population:

	1960	1970
U.S. Average	160	361
Cities 250,000 or more	293.7	980.4
100,000 to 250,000	154.0	450.3
50,000 to 100,000	104.4	273.5
25,000 to 50,000	70.1	214.4
10,000 to 25,000	57.3	159.2
less than 10,000	47.7	141.4

(Data from Statistical Abstract of the United States 1973 U.S. Department of Commerce.)

Find the percent increase in U.S. population from 1960 to 1970. Find the percent increase from 1960 to 1970 of violent crime for the U.S. and for the cities of various populations.

Why is the number of violent crimes higher in areas of dense population growth than in less dense areas? Why is the percent increase for violent crimes for the U.S. greater than the increase in the population? Does overcrowding provide additional pressures on society that might result in more aggressive behavior on the part of individuals? Violent crime is only one example of aggressive behavior; what other examples of aggression do you see in society today? Are these results of population pressure?

PURPOSE: To demonstrate the effect of external pressure on modern man.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: V-1 Psychological and Behavioral Considerations - crowding

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: The basic needs of man and animals seem to be approximately the same. These needs include a suitable living area, freedom from stress, territory, and a stable reproductive process. Have students consider the plight of a caged animal. Few animals readily adapt to this condition. Some reference study or a visit to a zoo will reinforce this understanding.

Discuss a "caged" man. Such things as job pressures, tenement housing, crowded freeways, busy shopping centers, and overused recreation areas serve to trap human beings. What other factors can you think of which tend to "cage" man? What kinds of social pressure do various communities exert? What influences an animal in its selection of a home territory? Do human beings consider the same things when seeking a place to live?

Is the environment compatible with the needs of man? Explain. What adjustments or avenues of escape can man exercise to insure his well-being and survival that lower animals cannot make or use? How do rural, suburban, and urban environments each suit or thwart the needs of man? What evidences are visible that society may be breaking under the pressure of being "caged"?

PURPOSE: To depict changes in a community over time and to identify the factors that bring about this change.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "History and the Environment." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: Divide the class into groups. Using a basic map of the community, have one group draw in an outline of the community as it exists today; have a second group show the area as it was 25 years ago; a third group should depict it as it was 50 years ago; and a fourth group, as it was 100 years ago. This information can usually be obtained from town records. To discover what your local area was like in the eyes of its residents, have one group interview residents of the town who have lived there for 25 years. Have another group interview a 40- to 50-year resident of the community. When all data have been collected and summarized, list the changes which have occurred. Why did these changes occur? Were these these changes helpful or harmful? Explain. Looking ahead, based on what we know now, what changes do you foresee? Will these be helpful or harmful? Explain. What can we do to prevent the harmful ones? How could this process you have employed be modified for use on a national scale?

PURPOSE: To understand the enormity of the litter problem along major highways.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: I-4 Aesthetic Considerations - litter

ACTIVITY: Invite a representative of the State Highway Department to come to class and discuss the nature of litter picked up by maintenance crews along major highways in the area. Ask for cost estimates of such clean-up work and also ask about the effectiveness of laws that indicate heavy fines for persons caught littering.

Indicate that the class, or an appropriate number of students from the class, would like to pick up all litter along a one mile stretch of major highway for the purpose of determining kinds and amount of litter found. Relate that the students would like to repeat the project one, two or four weeks later to get some indication of the amount of litter left along the highway annually. Indicate class willingness to work closely with the highway department or the state highway patrol to insure safety of all students working on the project.

Plan with local newspapers or TV stations to dramatize the results obtained and to urge more citizen responsibility to reduce littering.

PURPOSE: To determine community members satisfaction with their environment.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

ACTIVITY: Involve the class in developing a list of concerns or problems in their community which they regard as important to themselves, and likely to other community residents. The list in an urban community may include such things as dangerous traffic, inadequate playgrounds, litter, noise, crime, jobs, and others.

After a list of ten or more concerns has been developed, ask the students to rate their neighborhood or community as above average, average, or below average on the items. (The group obviously will need to agree on what they consider to be "average".)

Ask each student to get his parent(s) and two neighbors to rate the neighborhood on these factors. Ask also for their suggestions about what should be done to improve conditions judged to be below average. Pool the interview results in class and compare the perceptions of parents and other adults with those of students. Is there agreement? Why or why not? Is there anything the class might undertake as a project to improve the community environment?

PURPOSE: To examine use of recreational facilities in the community.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions and life-ways that are transmitted to its progeny.

PROBLEM: I-11 Aesthetic Considerations - recreational facilities

ACTIVITY: Involve the class in locating all known indoor and outdoor recreational facilities in the school's attendance area. Develop a matrix in which the facilities can be categorized as public or private, free or pay to use, hours available for use, types of activities available, level of use, and so forth. Discuss with the class the extent to which they believe the recreational facilities satisfy the needs of youth in the community.

Are school facilities available for community use after school hours? Over weekends? During vacation time? Should they be open during such times?

Select a small committee of students to interview city recreation personnel to ascertain how they feel about the availability of school facilities for community recreation programs? If they aren't satisfied with the present situation what suggestions can they offer to improve it? Select a second committee of students to raise the same questions with school system administrators and/or board of education members. Where do the two groups agree? Disagree?

What can students and their parents do to assure that recreational facilities will be used to the best advantage? Challenge the class to develop a specific suggestion and make arrangements to have it tested.

PURPOSE: To examine value conflicts involved in improving standards of living.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: Multi-Disciplinary Environmental Education Activities. Florida State Department of Education, Tallahassee, David E. Lahart and Richard C. Tillis, Editors, 1974.

ACTIVITY: Reading the following statement to the class.

> If people must choose between having money with pollution and having nothing without pollution, they would take the money. If an old machine can be replaced by one that goes faster and the owner makes more money by it, he will discard the old machine. Greater profits mean a higher standard of living and that's what everybody wants.

Ask the class to discuss questions such as the following:

1. What do you value more than money?
2. Do you agree that everybody wants more money and all it can bring?
3. What is meant by a higher standard of living? How high is yours going to be?
4. What material things do you now own that you'd be willing to give up? Which would you keep?
5. If you could change one thing in your community's environment, what would it be? How would you go about it?

PURPOSE: To review fundamental cultural differences.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Conservation News. National Wildlife Federation, November 15, 1973.

ACTIVITY: Involve the class in a careful reading of the statement below that was sent by an American Indian Chief in 1855 to an American President.

To what extent did the chief truthfully depict the white man's values; the white man's attitude toward land and wildlife? Why was there such a difference between the values of white men and Indians? Does the same difference now exist among various groups of Americans? Is the difference reconcilable? Why or why not?

> "The Great Chief in Washington sends word that he wishes to buy our land. How can you buy or sell the sky--the warmth of the land? The idea is strange to us. Yet we do not own the freshness of the air or the sparkle of the water. How can you buy them from us? Every part of this earth is sacred to my people. Every shiny pine needle, every sandy shore, every mist in the dark woods, every clearing and humming insect is holy in the memory and experience of my people.
>
> "We know that white man does not understand our ways. One portion of the land is the same to him as the next, for he is a stranger who comes in the night and takes from the land whatever he needs. The earth is not his brother but his enemy, and when he has conquered it he moves on. He leaves his father's graves, and his children's birthright is forgotten.
>
> "There is no quiet place in the white man's cities. No place to hear the leaves of spring or the rustle of insect wings. But perhaps because I am savage and do not understand--the clatter only seems to insult the ears. And what is there to life if a man cannot hear the lovely cry of the whippoorwill or the arguments of the frog around the pond at night.

"The whites too, shall pass--perhaps sooner than other tribes. Continue to contaminate your bed and you will one night suffocate in your own waste. When the buffalo are all slaughtered, the wild horses all tamed, the secret corners of the forest heavy with the scent of many men, and the view of the ripe hills blotted by talking wires. Where is the thicket? Gone. Where is the eagle? Gone. And what is it to say goodbye to the swift and the hunt, the end of living and beginning of survival."

Chief Sealth of the Duwanish Tribe in Washington wrote these words in a letter sent to President Franklin Pierce in 1855.

PURPOSE: To allow students to explore their own environmental values.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: Man and His Environment. Environmental Science Study Curriculum, P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: On the chart below are listed several "environmental items" to be sold at auction to the highest bidder, according to the following rules:

1. Without these values you would still survive and have all your basic needs.
2. You are to pretend that you presently have none of the items listed.
3. You have a total of $5,000 to spend.
4. You may spend no more than $2,500 on any one item.
5. Bids must open at no less than $50 and no more than $500, and must proceed by increments of no less than $50 and no more than $100.

This auction is not a measuring device. It helps to clarify value priorities and valuing processes and to stimulate dialogue about same, and nothing more. Teachers are encouraged to experiment with this game, modifying its content and its procedures in any ways that seem appropriate.

	Budget	Highest Amount I Bid	Top Bid in Group
1. A long life free of illness			
2. The ability to travel anywhere in the world as often as you wish			
3. The love and admiration of friends			
4. Television			
5. An unspoiled natural place to live			
6. Complete self-confidence with a happy outlook on life			
7. A happy family relationship			
8. An automobile			
9. A very satisfying love relationship			
10. The ability to paint or play any musical instrument			
11. A chance to eliminate sickness and poverty without increasing the population			
12. Electricity			
13. An understanding of the meaning of life			
14. All the records or tapes you ever want			
15. A world without prejudice			
16. A world without air and water and land pollution			
17. The chance to produce all your own food			

PURPOSE: To examine the present status and future role of nursing homes.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: II-6 Health Considerations - medical treatment

REFERENCE: "Nursing Homes Yesterday, Today, and Tomorrow" E. Russell Jackson, Journal of Environmental Health, Sept./Oct. 1974.

ACTIVITY: Secure from the World Almanac or other appropriate source data that indicates the aging nature of the American population during the past 40-50 years. Give particular attention to the number of Americans over 65, 70, 75, and 80 years of age.

Secure from an article such as the one cited above, or from another magazine, data that show the growth of the nursing home business in America during the past 40 years. Why has this occurred? What has been good about it? What has been bad?

Invite someone who manages or works in a local nursing home to visit the class and discuss costs, services provided, needs of patients, job opportunities, etc. as they are present in the home. What, if anything, can be done by high school age youth to make life more pleasant for old people? If interest is present in the class arrange for a small group or class visit to a local nursing home to provide some useful service and to learn more about nursing home operations and the role such places can and should play for an aging population in the years ahead.

PURPOSE: To examine the idea of more "Farmers' Markets" in cities.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: "Environmental Action Bulletin" Vol. 5 No. 24, Aug. 24, 1974.

ACTIVITY: Review with the class the "spread" between prices the farmer or food producer gets for what he sells and the prices charged in urban supermarkets for that food. If possible involve students in getting actual produce market prices from a daily newspaper and current prices of foods on supermarket shelves.

Ask students to develop a list of factors such as transportation costs, refrigeration, labor, packaging, taxes, police protection, etc., that are responsible for the total mark-up which may be as much as 60-100% of the price paid to the farmer.

Farmers and some consumer groups advocate the growth of "farmers' markets." The city would provide an open space where farmers could truck in their produce and sell directly to the consumer at prices substantially lower than those charged in supermarkets.

Divide the class into groups that favor and oppose this idea. Ask each group to collect data and marshall arguments for their position and subsequently present them to the class. Finally ask the class to vote on whether they think more "farmers' markets" would be good or bad for their city.

PURPOSE: To sense recent changes in our school-going population.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: "Interchange" - Population Education Newsletter Vol. 3 No. 3 Population Reference Bureau, Inc., 1755 Massachusetts Ave., Washington, D.C. 20036.

ACTIVITY: Ask each student to indicate the level of education he desires to reach. Ask each student also to indicate the level of education reached by his parent(s) and grandparent(s). Organize the data into a matrix showing levels of education reached or aspired to according to sex, age, race, and place of residence (rural or urban) during school age years. Compare the data obtained from the class with data shown below taken from the 1970 census.

Conduct a classroom discussion using questions such as the following: Do students desire more formal education than their parents had? Why or why not? What problems might result if more and more people are better educated? Can a population be over-educated? Are factors such as income, kind of job, age of marriage, and family size related to level of education? Now that almost all American children go to school are they getting the kind of education most valuable to all children? Why or why not?

PERCENT OF HIGH SCHOOL GRADUATES BY AGE, SEX AND RACE: UNITED STATES, 1970

Female

Age	White	Black	American Indian
55-64	47	17	25
35-44	66	39	35
22-24	81	63	59

Male

Age	White	Black	American Indian
55-64	41	14	22
35-44	62	35	34
22-24	81	60	57

Source: U.S. Bureau of the Census

PURPOSE: To examine the practice of using non-returnable beverage containers.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: At an appropriate time during a social studies unit on natural resource use indicate that the use of "throw away" bottles and cans for beverages is a recent development in American merchandizing. Involve the class in listing the advantages and disadvantages of this development.

Ask students to examine the beverage departments in super-markets and "carryout" stores to ascertain how many offer the customer a choice of returnable or non-returnable containers. If returnable bottles are not available suggest that students ask the manager or one of his employees to indicate why this is the case. Have them also ask what must be done to make returnable bottles available to customers.

Pool the findings of all students in a subsequent class period. Discuss the extent to which students accept or reject the judgments expressed by store managers and/or workers. Finally ask each student to write a short "position paper" on how he feels about using returnable rather than non-returnable beverage containers.

PURPOSE: To review problems and issues associated with strip-mining.

LEVEL: 4-6
7-9

SUBJECT: Social Studies
Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Living Within Our Means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Show the children pictures and/or colored slides of current strip mining operations, areas previously stripped (reclaimed as well as untouched), and the huge power machines used in strip mining. Have the children research where strip mining is most prevalent and locate these places on a large map of the United States. Discuss some of the reasons for and against strip mining to develop understanding that this is a very complex problem facing our society, especially in this period of energy shortages.

Divide the class into three groups to research further the positions taken on strip mining by the coal industry, by "environmentalists," and by the local community whose jobs often depend on the coal industry. After research in magazines, books, films, and through interviews set up a "mock hearing" in class at which each group might present its point of view on questions such as the following:

How has most of our coal been mined until recent years. What were some of the advantages and disadvantages of this type of mining?

How does strip mining hurt the environment? What is its effect on water? On flooding? On the nearby vegetation? On the appearance of the land?

What are some ways to prevent the harmful effects of strip mining? Why have these precautions not been taken before?

What is the government doing about strip mining?

Why might local people not be opposed to strip mining?

How has the energy crisis affected opinions about strip mining?

PURPOSE: To understand relationships between energy use and standard of living.

LEVEL: 4-6
7-9

SUBJECT: Social Studies
Science

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-4 Eco-Community Relationships - energy production

ACTIVITY: Review with the class the importance of slaves in enriching the lives of kings or very rich people in earlier times. With imput from the class develop a list of work done by slaves for their masters such as cooking food, carrying water, carrying people, removing garbage, cleaning rooms, securing fuel, moving air by hand-operated fans, making music, and so forth.

Indicate that each American today is likely to have the equivalent of more than 300 "mechanical slaves" at his command. What do these "slaves" do? Are we likely to want more and more such slaves in the years ahead? Why or why not? Do you believe people in less developed countries in Asia, Africa, and Central America also desire to have such mechanical slaves? If so, would this be possible?

Discuss the advantages and disadvantages associated with increasing use of such "energy slaves."

PURPOSE: To examine people's attitudes toward automatic car washes.

LEVEL: 7-9

SUBJECT: Social Studies
Science

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

ACTIVITY: At an appropriate time when studying about energy conservation, automation, or water conservation raise questions with the class about the desirability of the automatic car washes now in such common use throughout the U.S.A. Get estimates of water used to wash a car in an automatic washer; make "guesstimates" about the amount of electricity required to operate the conveyor, brushes, and blower. Select two or three students to visit an automatic car wash and, if possible, get data on the amounts of water and electricity used in washing a car.

Discuss the findings in class and raise questions about the likelihood of energy and water shortages reducing the number of automatic car washes. Should it be cheaper to wash a car "by hand" than in an automatic washer? Why or why not? Would individuals in the class be willing to wash a car for the amount of money charged by the car wash? Would the class members be interested in sponsoring a Saturday morning hand-car-wash session to raise money and/or save energy?

PURPOSE: To learn the value of an open space in an urban setting.

LEVEL: 7-9

SUBJECT: Social Studies
Language Arts

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: I-7 Aesthetic Considerations - open spaces

ACTIVITY: Man enjoys managing and controlling things; yet he often fails to adequately manage his own home environment. This activity deals with the value of managing urban areas to include open spaces, such as parks. Information on the value of parks can be obtained by surveying the residents who live in an area where there is no park and residents of an area which has a park.

The first part of the activity consists of writing the survey instrument. If the students plan to make a door-to-door survey of the two areas, the instrument should include questions to be asked and space for writing down the residents' responses. Include such questions as:

What features do you like best about the neighborhood?
What features do you like least?
Would you prefer to move to an area where there is a park nearby?
What kinds of things do you like to do in a park?
Does the park make the area more attractive to you?
What are the disadvantages of having a park in the area?
Do you meet more of your neighbors because of the park?

An interview with a real estate agent about the value of the homes near a park might be helpful. After the survey has been conducted, summarize the data. What are the advantages and disadvantages of open spaces in a neighborhood? What is the community doing to establish more parks? How are small neighborhood parks different from the large, recreational parks?

Is there an abandoned lot in your area? Perhaps the community would provide money for students to establish a park in the vacant lot.

PURPOSE: To have the students consider ways that food in the home can be "recycled" and food wastes decreased.

LEVEL: 4-6
7-9

SUBJECT: Social Studies
Home Economics

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: "Recycling for Relaxation." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: As an out-of-class assignment have the students for a week keep a list of the waste food that is thrown away in their homes. Using the list in class consider how some of this food could be "recycled" or re-used.

Seeds and pits - Many fruits and vegetables have seeds that can be used for planting and growing more food. Most of the seeds would have to be washed thoroughly and dried before using. Most county extension agents have pamphlets or free material on growing specific vegetables. (Look in your telephone book under your state.

Compost pile - Most food wastes can be used in starting a compost pile which can be used for fertilizer around the home. Grass cuttings from the lawn can also be used.

"Soft" fruits and vegetables - Many foods that are not in good enough condition to serve directly can be used in making jams and jellies, or soups and stews.

Leftovers - Leftover food is often thrown away or hidden in the refrigerator until it spoils. Special creativity is needed in preparing meals from leftovers; many cookbooks have special recipes on how to use this food. Have the students find a special recipe and, if possible, prepare a meal in class.

PURPOSE: To become more aware of future problems and possible solutions.

LEVEL: 4-6
7-9

SUBJECT: Language Arts

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Environmental Education K-8 Curriculum, West Salem Elementary School, West Salem, Wisconsin.

ACTIVITY: Ask each child to write a short story on "How I Think My City, Town, or Home Will be Changed by the Time I Am 25 Years Old."

Have children who are willing read their stories to classmates and record on the chalkboard after each story whether the author anticipated changes in heating, transportation, food, land usage or other areas. After several stories have been read identify the most frequently cited areas of likely change. Why did they select these areas? What might happen to make their predictions incorrect? Are they happy about the anticipated changes? Why or why not? If they are unhappy,what, if anything, can they or their parents do about it?

PURPOSE: To help students examine more carefully the environmental characteristics of the city in which they live.

LEVEL: 4-6
7-9

SUBJECT: Language Arts
Social Studies

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Environment and Society - People and Cities. The University of the State of New York, The State Education Department, Bureau of Continuing Education Curriculum Development, Albany, New York 12224, 1974.

ACTIVITY: During a social studies unit devoted to understanding more about the city in which they live the children can understand that cities are paradoxical. Examples can be found to show that their city is a wonderful, beautiful, stimulating and sophisticated place. It is likely to offer museums, libraries, universities, art galleries, hospitals, theaters, concerts, exotic shops, big league sports and other attractions.

On the other hand the children will learn that in some ways or places their city is horrible, ugly, and deadening to some of its inhabitants. The city has a crime problem, squalor, poverty, and disease. Hatred and despair can be found in some neighborhoods and depicted in graffiti.

As a summary activity for the unit study have each student write a letter that could be sent to someone they know or to a fictitious person who is considering moving to his city. In the letter he should describe both the good and bad features of his city with specific information about available housing, job opportunities, cultural and recreational opportunities, safety, and other items studied in the unit. The letter should point toward making a recommendation that the prospective migrant should or should not come to this city.

Have some (or all) of the letters read to the class. Do class members think this is a good place to move to or a place to stay away from? Why?

PURPOSE: To affect attitudes toward water pollution through musical interpretation.

LEVEL: 4-6
7-9

SUBJECT: Fine Arts

CONCEPT: I-5 The natural environment is irreplaceable.

PROBLEM: I-6 Aesthetic Considerations - water quality

REFERENCE: Water Pollution. Environmental Education Curriculum, Topeka Public and Parochial Schools, Topeka, Kansas 66612.

ACTIVITY: Bring to the class a song that describes the ocean or a river or the moods these create. Such traditional songs as "Shenandoah," "Beautiful Ohio," and "On the Bank of the Wabash" may be used. Have the students learn the song and discuss the characteristics of the river that might have inspired the songwriter. Perhaps songs about local bodies of water can be found or may be written by the students. A song about a polluted river might also be effective. Many classical compositions, such as Debussy's "La Mer," may also be used in interpreting "mood" and characteristics of rivers and oceans.

PURPOSE: To use free poetry to picture, as well as verbalize, the environment.

LEVEL: 7-9
10-12

SUBJECT: Language Arts

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: I-3 Aesthetic Considerations - visual pollution

REFERENCE: Environmental Education Guide - Language Arts 7-8. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Poetry may not only describe scenes in words, but in the shape of the words as well. Poems may be diamond-shape (diamante) or shaped like the object being described. One suggestion is to write the poem on top of a picture or sketch of the scene being described. By strategically placing the words on the picture, the readers' attention can be drawn to certain points.

Have the class visit a site or view a scene where pollution of the environment is evident. Let the students express their feelings about the scene in free poetry.

An example, taken from Street Poems by Robert Froman (McCall Publishing Co.), is:

O F F A N D A W A Y

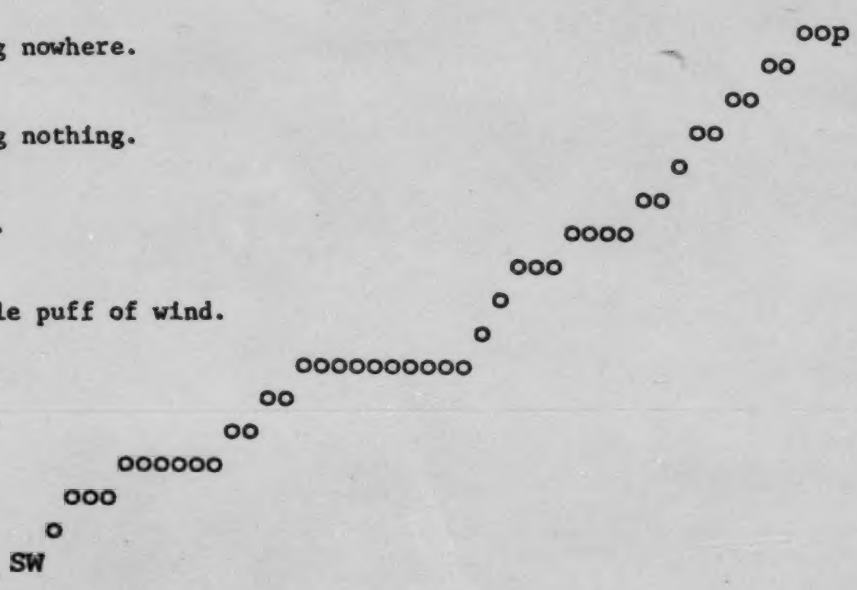
Little piece of paper on the ground.

Going nowhere.

Doing nothing.

Flat.

Little puff of wind.



PURPOSE: To stimulate concern for the environment through the arts.

LEVEL: 7-9
10-12

SUBJECT: Fine Arts

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: I-10 Aesthetic Considerations - cultural opportunity

REFERENCE: "Man vs. Nature - An Environment Study." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: An art class or a group of interested students could sponsor an environmental arts and crafts show. As a part of the show arts and crafts could be displayed, demonstrations given on making environmental crafts, and mini-lessons taught on art and the environment. Some areas to include may be:

1. Creative Writing
   Student works comparing natural and man-made objects.
   Study of Thoreau's Walden Pond. Similar student works.
   Poetic forms and styles (sometimes the poem takes the shape of the object being described.)

2. Sensory Awareness
   Using senses, other than just sight, to identify and appreciate man-made and natural materials; for example: a "Smell the Earth" exhibit.

3. Photographic Studies
   Displays of photographic art.
   Essay pictures similar to the book The Family of Man.
   Slide/tape presentations.
   Double exposure displays showing opposites in natural and man-made objects, in human experiences, in social phenomena.

4. Arts and Crafts
   Crafts from the natural world, e.g., dried flowers, pine cone art, root rubbings and plant dyes.
   Crafts from the man-made world, e.g., macrame, batik, candle-making.
   Environmental cooking.
   Dance - interpretation of impressions of nature, of man's world.
   Music - original musical instruments and demonstrations. Analysis of modern song about nature and man.

PURPOSE: To identify and illustrate student concerns about their environment.

LEVEL: 7-9
10-12

SUBJECT: Fine Arts

CONCEPT: IV-4 Man has been a factor affecting plant and animal succession and environmental processes.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Environmental Education Guide (Art 7-9) Project I-C-E, (Instruction-Curriculum-Environment) 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Present to the class the following major environmental concept (one of twelve) found in the reference cited above:

> Factors such as facilitating transportation, economic conditions, population growth, and increased leisure influence changes in land use and population densities.

Engage the class in verbalizing some of their impressions concerning how land use and/or population density has been affected by these factors. Urge them to draw on their knowledge of earlier, simpler, cultures as well as their knowledge of the present fast-changing world.

Suggest that environmental problems or concerns might be presented more forcefully by a well designed and created poster or collage than by mere words. Ask students, working alone or in pairs, to create posters that will communicate forcefully some of their concerns about their environment.

After the posters are completed discuss their effectiveness in the class and select some of the better ones for display in the school or in a store, bank, or other building.

PURPOSE: To examine relationships between advertising and environmental concerns.

LEVEL: 7-9

SUBJECT: Fine Arts
Language Arts

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-12 Eco-Community Relationships - effects of humans on ecosystems

REFERENCE: Multi-Disciplinary Environmental Education Activities, Florida State Department of Education, Tallahassee. David E. Lahart and Richard C. Tillis, Editors, 1974.

ACTIVITY: Examine with the class a series of effective advertisements clipped from popular magazines and newspapers. Ask the class to determine in each advertisement the claim(s) made for the product or service and also the appeal being made to the potential consumer. Why are claims less prominent in advertising than they formerly were? What evidence, if any, can be marshalled to prove that advertising based on appeals to vanity, masculinity, femininity, and so forth are effective?

Ask students to select an advertisement from print, billboard, radio, or television and prove by rational argument or through empirical means that the advertisement is directly or indirectly damaging to the environment.

Finally, ask students working alone or in small groups to create an original advertisement or series which (a) exposes advertising that is damaging or potentially damaging to the environment or (b) focuses attention on some present or potential environmental problem that demands public attention and/or action.

GRADE LEVEL 10 - 12

Activities	
Science	7
Science-Social Studies	3
Mathematics	1
Social Studies	20
Social Studies-Science	1
Physical Education	1
Language Arts	2
Fine Arts	2

PURPOSE: To identify pollen as a natural air pollutant.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: II-3 Health Considerations - air quality

REFERENCE: Air Pollution Experiments for Junior and Senior High School Science Classes. Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

ACTIVITY: Ragweed pollen is a natural pollutant to which many people are allergic. During late August and early September, large quantities of ragweed pollen are released into the air; the pollen release occurs early in the morning as the rising sun dries the pollen sacs and causes them to burst. Most of the released pollen settles to the ground after being airborne for about 200 feet. This activity provides a method for collecting and counting the pollen. To collect the pollen, obtain a clear glass slide and cover one side with a smooth, very thin film of grease; silicone stopcock grease or its equivalent is a good type to use. Use a wax pencil to mark the greased side of the slide with an X; take care not to touch or smear the greased surface. Collect your sample on the roof of a 2 or 3 story building, well away from any structures that might affect the free movement of air; the sample should be 30" higher than any railing or wall on the roof. A Durham sampler may be built to hold the slide or the slide can be held by clothespins attached to a wooden frame; the slide should be situated so that its long axis is parallel to the prevailing wind direction. Begin each sample early in the morning (8:00 a.m.) and continue for 24 hours. Ragweed pollen can be counted directly from the greased slide with a 100X microscope. Under this magnification the ragweed pollen grains would look like small straw-colored golf balls. Determine a 2 sq. centimeter area (2.0 cm x 1.0 cm) for counting; divide the results by two in order to obtain an average number of pollen grains/cm^2. The counting area can be marked off with tape and a wax pencil on the non-greased side of the slide; a Whipple disc for the microscope eye-piece would be useful in providing a background of cross section lines to aid in counting.

PURPOSE: To study the effects of air pollution on vegetation.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-10 Eco-Community Relationships - effects of air quality on ecosystem

REFERENCE: Air Pollution Experiments for Junior and Senior High School Science Classes. Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

ACTIVITY: Sulfur dioxide is one of our most abundant gaseous air pollutants since it is a product of the combustion of most fuels. Certain strains of white pine (Pinus strobus) are particularly susceptible to very low concentration of sulfur dioxide in the air. The first noticeable change in the pine due to sulfur dioxide is a characteristic banding on the needles; several minute bands--each with a yellow-brown-yellow color arrangement--will occur on the needles accompanied by a slight swelling (usually only visible with a microscope) at each band.

Once affected trees are identified, various studies can be conducted by the class. Tagged trees can be observed and records kept over long periods of time to note changes in the tree; comparisons with healthy trees would be important. Affected needles usually fall in the winter rather than remaining on the tree; needle growth is often noticeably stunted.

Microscopic studies of needle surface and cross-sections and longitudinal sections can be made. Other strains of white pine seem to be susceptible to other air pollutants. Some consideration is being given to the use of pines in detecting and quantifying air pollution.

PURPOSE: To develop an awareness of environmental advertising.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: "Environmental Education - Concepts, Strategies, Instructional Activities." Board of Education of Harford County, Bel Air, Maryland 21014.

ACTIVITY: Have the students keep a record or log of television commercials, newspaper and magazine ads that relate to the environment; pay particular attention to ads for products which might contribute to pollution problems. Try to determine if the advertising in any way reflects a growing concern on the part of the businesses for prevention of further environmental degradation. Also notable would be any commercials which seem to be directed toward helping the public better understand some of the problems and hazards involved in using many products, such as detergents and pesticides.

Carefully study ads which are suspect. Are quoted statistics correct? Are all factors adequately considered? If the ad states that the company pollutes "less," does it state "less" than what? How are pictures of pristine environments used to influence the attitudes of the viewers?

Display ads which are brought to class. Point out legitimate uses of advertising, as well as the ads with the "catches."

How influential are environmental advertisements? A survey of students in the school on their responses to displayed ads might be helpful.

PURPOSE: To demonstrate the effects of air pollution on material in clothing.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-10 Eco-Community Relationships - effects of air quality on ecosystem

REFERENCE: Air Pollution Experiments for Junior and Senior High School Science Classes. Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

ACTIVITY: Material from good quality nylon hose should be mounted in small frames, such as the standard Polaroid slide mount (#633, 3 1/4 x 4") or similar size wooden frames. Cut squares of material from the hose and mount on the frame; prepare several samples. Place the mounted nylon in a safe place on the school roof; support the frames in a horizontal position so that air can pass through the material from both sides. Expose the nylon to the air for various lengths of time from 30 to 90 days; examine the samples at the end of exposure, keeping careful records of the number of broken threads. With careful planning in setting out the samples, the end of the various periods of exposure could occur all on the same day; this would allow for direct comparisons of samples. An easy, quick way to examine the nylon samples is project the mounted sample on a screen with a slide projector.

Discuss the various types of air pollution which may be causing the destruction of the nylon: sulfuric acid in soot particles, hot particles in smoke, acid aerosols, nitrogen oxides, phenolic particles and aldehydes, and solvent vapors and droplets.

PURPOSE: To learn how environmental factors control the species of organisms that occur in a particular ecosystem; to study an aquatic ecosystem.

LEVEL: 7-9
10-12

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: IV-7 Eco-Community Relationships - species control (non-human)

REFERENCE: "Teaching Materials for Environmental Education" Forest Service, U.S. Department of Agriculture.

ACTIVITY: This activity should follow a study of a stream or pond environment where the students have observed and identified the aquatic organisms. It is the chemical and physical characteristics of the water which determine which species of organism is present; consequently by knowing which organisms are present, students should be able to predict the characteristics of the water.

Using the tables given on the next page, each student should be able to complete the following predictions:

I predict:

The water temperature will be _____because_____.
The air temperature will be _____because_____.
The water pH will be _____because_____.
The dissolved oxygen (D.O.) in the water will be _____ because _____.

After having made and justified their predictions, the students should verify the actual values of the water characteristics by using one of the commercially available water testing kits.

pH RANGES THAT SUPPORT AQUATIC LIFE

MOST ACID — MOST ALKALINE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bacteria	1.0												13.0	
Plants (algae, rooted, etc.)						6.5						12.0		
Carp, suckers, catfish, some insects						6.0			9.0					
Bass, crappie						6.5		8.5						
Snails, clams, mussels							7.0		9.0					
Largest variety of animals (trout, mayfly, stonefly, caddisfly)						6.5	7.5							

DISSOLVED OXYGEN REQUIREMENTS FOR NATIVE FISH AND OTHER AQUATIC LIFE
(D.O. in parts per million)

Cold-Water Organisms including (salmon and trout) (below 68°)
- Spawning ..... 7 ppm and above
- Growth and well-being ..... 6 ppm and above

Warm-Water Organisms (including game fish such as bass, crappie) (above 68°)
- Growth and well-being ..... 5 ppm and above

TEMPERATURE RANGES (APPROXIMATE) REQUIRED FOR GROWTH OF CERTAIN ORGANISMS

Temperature		Examples of life
Greater than 68° (warm water)		Much plant life, many fish diseases. Most bass, crappie, bluegill, carp, catfish, caddisfly.
Less than 68° (cold water)	Upper range (55-68°)	Some plant life, some fish diseases. Salmon, trout, stonefly, mayfly, caddisfly, water beetles, striders
	Lower range (Less than 55°)	Trout, caddisfly, stonefly, mayfly

PURPOSE: To understand that we live in a radioactive world and that radiation is part of our natural environment.

LEVEL: 10-12

SUBJECT: Science

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: II-2 Health Considerations - radioactivity

REFERENCE: Nuclear Power and the Environment: Questions and Answers. American Nuclear Society, 1973.

ACTIVITY: Review with the class the sources of radiation energy to which they are exposed in their environment. Cosmic rays, X-rays, television sets, and microwave ovens would probably be cited by students. Discuss the fact that small amounts of radioactive materials are found in common rocks, in building materials, in air, food, and water. If possible demonstrate the existence of background radiation in the air or rocks or building materials with a sensitive Geiger counter.

Using the table below, ask students to calculate the millirems of radiation they receive from common sources in a year. Are they worried about this condition? Should they be worried about radiation from nuclear power plants? Why or why not?

	Common Source of Radiation	Your Annual Inventory
WHERE YOU LIVE	Location: Cosmic radiation at sea level Add 1 for every 100 feet of elevation Typical elevations: Pittsburgh 1200; Minneapolis 815; Atlanta 1050; Las Vegas 2000; Denver 5280; St. Louis 455; Salt Lake City 4400; Dallas 435; Bangor 20; Spokane 1890; Chicago 595. (Coastal cities are assumed to be zero, or sea level).	40
	House construction (¼ time factor): Wood 35; Concrete 45; Brick 45; Stone 50	—
	Ground: (¼ time factor): U.S. Average	15
WHAT YOU EAT, DRINK & BREATHE	Water, Food, and Air: U.S. Average	25
HOW YOU LIVE	Jet Airplanes: Number of 6000-mile flights _____ x 4	—
	Television viewing: Black and white Number of hours per day _____ x 1 Color Number of hours per day _____ x 2	— —
	X-ray diagnosis and treatment: Chest x-ray _____ x 100-200 Gastrointestinal tract x-ray _____ x 2000 Dental x-ray _____ x 20	— — —
	Compare your annual dose to the U.S. Annual Average of 225	Sub Total ___mrem
HOW CLOSE YOU LIVE TO A NUCLEAR PLANT	At site boundary: Annual average number of hours per day _____ x 0.2 One mile away: Annual average number of hours per day _____ x 0.02 Five miles away: Annual average number of hours per day _____ x 0.002 Over 5 miles away: None	— — —
		Total ___mrem

One mrem per year is equal to: Moving to an elevation 100 feet higher
Increasing your diet by 4%
Watching one additional hour of black and white TV per day
Taking a 4-6 day vacation in the Sierra Nevada Mountains.

PURPOSE: To understand some of the problems and risks associated with the Green Revolution.

LEVEL: 10-12

SUBJECT: Science

CONCEPT: I-3 An organism is the product of its heredity and environment.

PROBLEM: III - Genetic Considerations

REFERENCE: "Green Revolution (II): Problems of Adapting a Western Technology" Science, Vol. 186 No. 4170, pp. 1186-1192, Dec. 27, 1974.

ACTIVITY: During the study of genetics in a high school science class ask a small group of students to read carefully the article cited above and if possible arrange for some interviews with research scientists in plant breeding, seed salesmen, and others who are concerned about the development and distribution of new varieties of plants. Particular attention should be given to plants such as the high yield varieties of wheat and rice that have been developed in Mexico, the Phillipines and the U.S.A. and then exported to different settings such as India and Pakistan.

When the group reports to the class on its findings from the article and interviews make certain the class discusses and understands concerns such as the following: (1) the vulnerability of new strains to disease and/or insects (2) the danger of reducing the genetic pool essential for future plant breeding programs (3) the dependence of many HYV's on high fertilizer and energy imput (4) the advantages and disadvantages of monocropping and intercropping in diverse countries such as the U.S.A., Burma, or India.

PURPOSE: To provide a mechanism for establishing priorities.

LEVEL: 7-9
10-12

SUBJECT: Science
Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

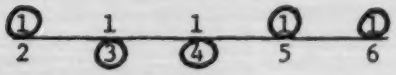
REFERENCE: Environmental Science Study Project. Where the Action Is. P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: During most considerations of environmental concerns, there comes a time when the students must establish some order of priority from a list of values, criteria, problems, etc. Pair weighing is one method for doing this. Let's suppose the following criteria have been listed by the students as important factors in considering what activities to do as a class:

1. Fun and interesting activity
2. Does not involve time outside school
3. Gives experience in new area
4. Helps the community
5. Does not take much money
6. Does not take students out of classes

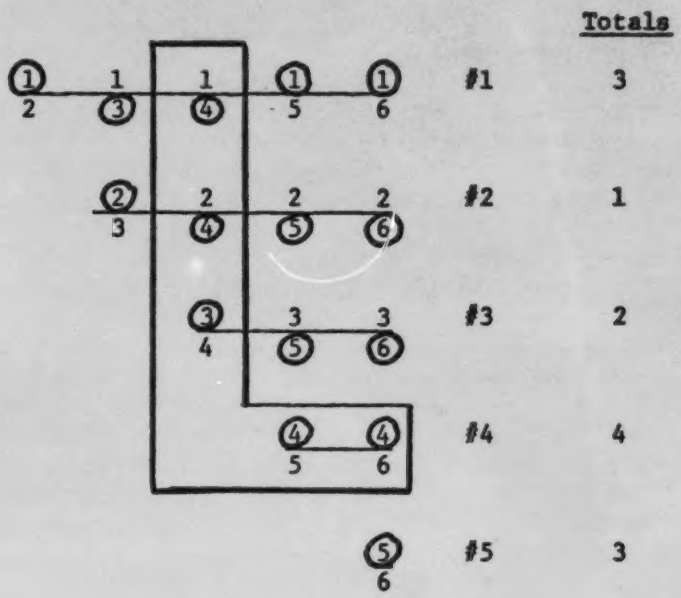
This list is not in order of importance; the numbers are assigned only for convenience.

Now each student pair-weighs each item. He decides which one criterion is most important to him for the pairing No. 1 (Fun and interesting activity) with No. 2 (Does not involve time outside school); then he compares #1 with #3, #1 with #4, #1 with #5, and #1 with #6. This can easily be done by a teacher reading out loud the two criteria being compared and the students responding without dwelling on the weighings. Each student should record his responses on the form by circling his preferred choice.



#1 =

The same procedure is followed in comparing criterion #2 with with #3, #4, #5, and #6; criterion #2 was already compared with #1 in the preceding step. If the form shown below is used, the results are easily tabulated.



Each student's chart should look like the one above (with different choices, of course). To tabulate the number of times criterion #1 was chosen simply count the number of circled "1's" horizontally across the first line; in this case, #1 received 3 favorable pair-weighings.

When tabulating the pair weighings for criteria 2-6, both horizontal and vertical readings must be made. For example, to tabulate the pair-weighings of criterion #4 (above chart) the students must read down the vertical column when #4 was compared with #1, #2 and #3 and then read horizontally where #4 was compared with #5 and #6; in this case the number of favorable pair-weighings for criterion #4 is four.

Each student should now have pair-weighing totals for each of the six criteria. The student totals for each criterion should be added together and a class average obtained. From the pair-weighing averages a priority listing of the criteria can be arranged with the criterion having the highest pair-weighing average being the first priority. The same procedure is followed whenever a priority listing is necessary.

PURPOSE: To become aware of dangers related to aerosol gases and to assess public concern about this problem.

LEVEL: 7-9
10-12

SUBJECT: Science
Social Studies

CONCEPT: I-1 Living things are interdependent with one another and their environment.

PROBLEM: III-2 Genetic Considerations - chemicals (air, water, food)

ACTIVITY: Ask two or three students to do library research on the affect of fluorocarbon gases such as Freons, used as propellants in aerosol cans, on the stratospheric ozone layer. Ask that the students report to their classmates on such things as (1) the quantity of such gases released into the air annually, (2) the chemical reactions that result in a depletion of the ozone layer, (3) the importance of the ozone layer as a radiation shield and (4) the relationship between intensity of radiation from the sun and the incidence of skin cancer.

Devise with the class a small number of questions to be used with parents or other adults to (1) determine if they are aware of the problem (2) their assessment of the seriousness of the problem and (3) their ideas about what, if anything, should be done about it.

Ask each student to report to the class the responses he got to the questions. Summarize the findings. What, if anything, do the responses suggest regarding a lack of communication among scientists, aerosol can manufacturers, the lay public, and government regulatory agencies?

PURPOSE: To become more aware of the critical importance of petroleum and natural gas.

LEVEL: 7-9
10-12

SUBJECT: Science
Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: As a homework assignment ask students to find the names of at least ten chemical substances that are made completely, or partially, from the basic resources of petroleum and/or natural gas. Urge them to go far beyond common substances such as gasoline and other petroleum distillates to plastics, fibers, drugs, fertilizers, pesticides and other organic compounds synthesized from hydrocarbon compounds.

Develop on the chalkboard a list of at least 50 substances they have found to come from hydrocarbon sources. Discuss the importance of these substances in the lives of individuals or the economic welfare of a country.

Discuss the idea that petroleum is much too important a substance to burn for heat when it appears to be so irreplaceable for future generations as a basic ingredient in organic chemistry.

Is it necessary and/or desirable for the modern technological world, particularly the United States, to change its life style to conserve more of this resource?

PURPOSE: To consider environmental matters while developing mathematical skills.

LEVEL: 7-9
10-12

SUBJECT: Mathematics

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Environmental Education Guide (General Math 9-12) Project I-C-E (Instruction-Curriculum-Environment) 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Mathematics teachers can find or develop problems such as the following that provides practice in basic mathematics skills while focusing on real environmental matters. Practice to develop skills (calculations) can be enlivened by student discussion on the relevance of the examples to their present and future living. The reference cited above includes many worksheets similar to the one below.

1. Research has shown that the average individual, during his lifetime, uses the following:

   3,000,000 gallons of water
   20,000 gallons of gasoline and creates
   46 tons of garbage.

   A. Expand this total to a family of six.
   B. Expand this total to the population of a community of 100,000.
   C. Expand this total to the population of a state of 4 million.

2. The garbage output averages 6 pounds per day per person. (This includes all output of garbage from all sources.) How much garbage from all sources will a city of 50,000 put out in a week? How many tons is this? If an incinerator can burn 5 tons per hour, how many hours will it take to dispose of one week's garbage?

3. At the time of takeoff, a four-engine jet pours out 88 pounds of air pollutants. If such a plane takes off every minute from an airport, how many pounds of pollutants are poured out into the air in 1 hour? In 1 day? In 1 week? In 1 month (30 days)? In 1 year? Convert all of these answers to tons.

PURPOSE: To allow students to explore their own environmental values.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: Man and His Environment. Environmental Science Study Curriculum, P.S. Jones Junior High School, Washington, D.C. 27889.

ACTIVITY: On the chart below are listed several "environmental items" to be sold at auction to the highest bidder, according to the following rules:

1. Without these values you would still survive and have all your basic needs.
2. You are to pretend that you presently have none of the items listed.
3. You have a total of $5,000 to spend.
4. You may spend no more than $2,500 on any one item.
5. Bids must open at no less than $50 and no more than $500, and must proceed by increments of no less than $50 and no more than $100.

This auction is not a measuring device. It helps to clarify value priorities and valuing processes and to stimulate dialogue about same, and nothing more. Teachers are encouraged to experiment with this game, modifying its content and its procedures in any ways that seem appropriate.

	Budget	Highest Amount I Bid	Top Bid in Group
1. A long life free of illness			
2. The ability to travel anywhere in the world as often as you wish			
3. The love and admiration of friends			
4. Television			
5. An unspoiled natural place to live			
6. Complete self-confidence with a happy outlook on life			
7. A happy family relationship			
8. An automobile			
9. A very satisfying love relationship			
10. The ability to paint or play any musical instrument			
11. A chance to eliminate sickness and poverty without increasing the population			
12. Electricity			
13. An understanding of the meaning of life			
14. All the records or tapes you ever want			
15. A world without prejudice			
16. A world without air and water and land pollution			
17. The chance to produce all your own food			

PURPOSE: To sense recent changes in our school-going population.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: "Interchange" - Population Education Newsletter Vol. 3 No. 3 Population Reference Bureau, Inc., 1755 Massachusetts Ave., Washington, D.C. 20036.

ACTIVITY: Ask each student to indicate the level of education he desires to reach. Ask each student also to indicate the level of education reached by his parent(s) and grandparent(s). Organize the data into a matrix showing levels of education reached or aspired to according to sex, age, race, and place of residence (rural or urban) during school age years. Compare the data obtained from the class with data shown below taken from the 1970 census.

Conduct a classroom discussion using questions such as the following: Do students desire more formal education than their parents had? Why or why not? What problems might result if more and more people are better educated? Can a population be over-educated? Are factors such as income, kind of job, age of marriage, and family size related to level of education? Now that almost all American children go to school are they getting the kind of education most valuable to all children? Why or why not?

PERCENT OF HIGH SCHOOL GRADUATES BY AGE, SEX AND RACE: UNITED STATES, 1970

Female

Age	White	Black	American Indian
55-64	47	17	25
35-44	66	39	35
22-24	81	63	59

Male

Age	White	Black	American Indian
55-64	41	14	22
35-44	62	35	34
22-24	81	60	57

Source: U.S. Bureau of the Census

PURPOSE: To examine the practice of using non-returnable beverage containers.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: At an appropriate time during a social studies unit on natural resource use indicate that the use of "throw away" bottles and cans for beverages is a recent development in American merchandizing. Involve the class in listing the advantages and disadvantages of this development.

Ask students to examine the beverage departments in supermarkets and "carryout" stores to ascertain how many offer the customer a choice of returnable or non-returnable containers. If returnable bottles are not available suggest that students ask the manager or one of his employees to indicate why this is the case. Have them also ask what must be done to make returnable bottles available to customers.

Pool the findings of all students in a subsequent class period. Discuss the extent to which students accept or reject the judgments expressed by store managers and/or workers. Finally ask each student to write a short "position paper" on how he feels about using returnable rather than non-returnable beverage containers.

PURPOSE: To examine the idea of more "Farmers' Markets" in cities.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: "Environmental Action Bulletin" Vol. 5 No. 24, Aug. 24, 1974.

ACTIVITY: Review with the class the "spread" between prices the farmer or food producer gets for what he sells and the prices charged in urban supermarkets for that food. If possible involve students in getting actual produce market prices from a daily newspaper and current prices of foods on supermarket shelves.

Ask students to develop a list of factors such as transportation costs, refrigeration, labor, packaging, taxes, police protection, etc., that are responsible for the total mark-up which may be as much as 60-100% of the price paid to the farmer.

Farmers and some consumer groups advocate the growth of "farmers' markets." The city would provide an open space where farmers could truck in their produce and sell directly to the consumer at prices substantially lower than those charged in supermarkets.

Divide the class into groups that favor and oppose this idea. Ask each group to collect data and marshall arguments for their position and subsequently present them to the class. Finally ask the class to vote on whether they think more "farmers' markets" would be good or bad for their city.

PURPOSE: To examine the present status and future role of nursing homes.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: II-6 Health Considerations - medical treatment

REFERENCE: "Nursing Homes Yesterday, Today, and Tomorrow" E. Russell Jackson, Journal of Environmental Health, Sept./Oct. 1974.

ACTIVITY: Secure from the World Almanac or other appropriate source data that indicates the aging nature of the American population during the past 40-50 years. Give particular attention to the number of Americans over 65, 70, 75, and 80 years of age.

Secure from an article such as the one cited above, or from another magazine, data that show the growth of the nursing home business in America during the past 40 years. Why has this occurred? What has been good about it? What has been bad?

Invite someone who manages or works in a local nursing home to visit the class and discuss costs, services provided, needs of patients, job opportunities, etc. as they are present in the home. What, if anything, can be done by high school age youth to make life more pleasant for old people? If interest is present in the class arrange for a small group or class visit to a local nursing home to provide some useful service and to learn more about nursing home operations and the role such places can and should play for an aging population in the years ahead.

PURPOSE: To review fundamental cultural differences.

LEVEL: 7-9
10-12

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Conservation News. National Wildlife Federation, November 15, 1973.

ACTIVITY: Involve the class in a careful reading of the statement below that was sent by an American Indian Chief in 1855 to an American President.

To what extent did the chief truthfully depict the white man's values; the white man's attitude toward land and wildlife? Why was there such a difference between the values of white men and Indians? Does the same difference now exist among various groups of Americans? Is the difference reconcilable? Why or why not?

> "The Great Chief in Washington sends word that he wishes to buy our land. How can you buy or sell the sky--the warmth of the land? The idea is strange to us. Yet we do not own the freshness of the air or the sparkle of the water. How can you buy them from us? Every part of this earth is sacred to my people. Every shiny pine needle, every sandy shore, every mist in the dark woods, every clearing and humming insect is holy in the memory and experience of my people.
>
> "We know that white man does not understand our ways. One portion of the land is the same to him as the next, for he is a stranger who comes in the night and takes from the land whatever he needs. The earth is not his brother but his enemy, and when he has conquered it he moves on. He leaves his father's graves, and his children's birthright is forgotten.
>
> "There is no quiet place in the white man's cities. No place to hear the leaves of spring or the rustle of insect wings. But perhaps because I am savage and do not understand--the clatter only seems to insult the ears. And what is there to life if a man cannot hear the lovely cry of the whippoorwill or the arguments of the frog around the pond at night.

"The whites too, shall pass--perhaps sooner than other tribes. Continue to contaminate your bed and you will one night suffocate in your own waste. When the buffalo are all slaughtered, the wild horses all tamed, the secret corners of the forest heavy with the scent of many men, and the view of the ripe hills blotted by talking wires. Where is the thicket? Gone. Where is the eagle? Gone. And what is it to say goodbye to the swift and the hunt, the end of living and beginning of survival."

Chief Sealth of the Duwanish Tribe in Washington wrote these words in a letter sent to President Franklin Pierce in 1855.

PURPOSE: To become aware of the world-wide trend toward urbanization.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: IV-1 Organisms and environments are in constant change.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: "Interchange" - Population Education Newsletter Vol. 3 No. 2 Population Reference Bureau, Inc., 1755 Massachusetts Ave., Washington, D.C. 20036

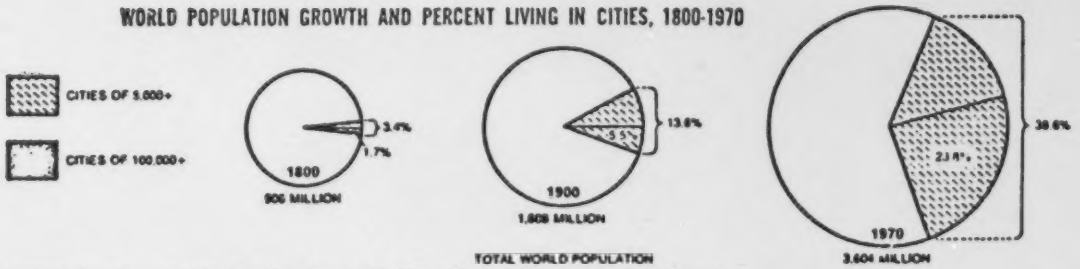
ACTIVITY: Present to the class by use of an overhead projector or some other effective means the data cited below concerning growth of world population and percent living in cities, 1800-1970 together with data indicating degree of urbanization of various geographic regions in 1970.

Present to the class the following challenge taken from the reference cited above: "During the last quarter of this century, the world will probably undergo the transition from a predominantly rural to urban society. Whether a majority of the world's people actually benefit from urban life or whether the problems of the rural areas (lack of jobs, poor education, poor health care, poor sanitation, etc.) are merely transferred to the cities will depend on the creative and realistic response of every nation."

Ask class members, working in groups of two or three, to develop two or three "creative and realistic" suggestions for improving the quality of city life. Ask them also to indicate whether their suggestions are appropriate for a society such as ours, a centrally controlled society such as found in USSR, or both?

Share in class discussion the group suggestions and predict the likelihood of the ideas being implemented within students' lifetimes.

WORLD POPULATION GROWTH AND PERCENT LIVING IN CITIES, 1800-1970



Source: Kingsley Davis, "The Role of Urbanization in the Development Process," *International Technical Cooperation Centre Review*, Tel Aviv, July, 1972.

DEGREE OF URBANIZATION BY REGIONS IN 1970

	Percentages[1]		
	Rural	Urban	City[2]
Australia-New Zealand	15.7	84.3	61.1
North America	24.9	75.1	57.4
Europe	37.0	63.0	38.9
USSR	37.7	62.3	31.4
Latin America	45.6	54.4	33.5
Asia	74.6	25.4	15.7
Africa	78.2*	21.8	11.2
Oceania	92.2	7.8	—

[1] The urban and rural percentages add up to 100.
[2] Percent of population living in cities of 100,000+.
Source: Kingsley Davis, *World Urbanization 1950-1970, Vol. II: Analysis of Trends, Relationships, and Development.* Population Monograph Series, no. 9, University of California, Berkeley, 1972.

PURPOSE: To understand the nature of population differences among countries.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: IV-6 Eco-Community Relationships - population studies

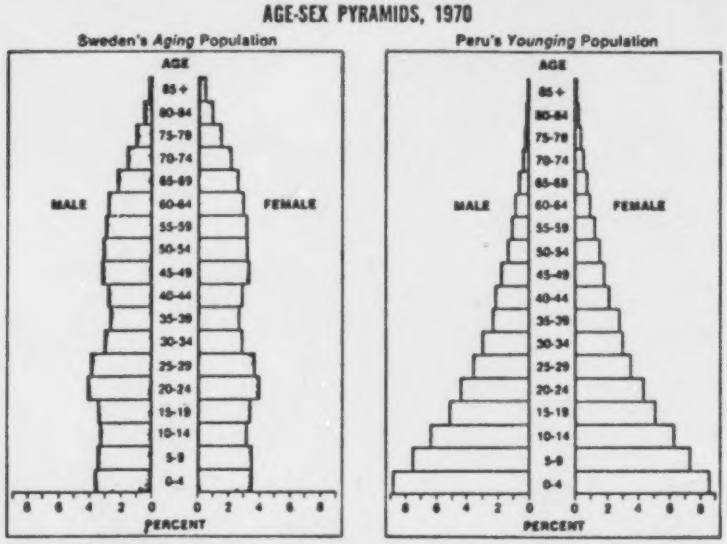
REFERENCE: "Interchange" - Population Education Newsletter Vol. 3 No. 3 Population Reference Bureau, Inc., 1755 Massachusetts Ave., N.W., Washington, D.C. 20036.

ACTIVITY: Present to the class through use of an overhead projector or by some other appropriate means, age-sex data from two contrasting countries such as that given below. Involve the class in identifying countries such as Great Britain, France, Germany, United States, and others that tend to have the Swedish pattern. Identify, also, countries such as Costa Rica, India, Bangladesh, Nigeria, and others that tend to have the Peru pattern.

With input from the class identify areas of socio-economic concern that are affected by the nature of a country's population such as need for elementary and high schools, need for adult educational opportunities, need for various kinds of recreational activities, need for different types of medical care, need for a growth economy, attitudes toward young and/or old people, and others.

Ask individuals to prepare a short paper or oral report to the class in which they examine the changes that have occurred and are continuing in the United States as a result of our changing population pattern. Is this pattern of change likely to occur in other countries in the years ahead? Why or why not?

AGE-SEX PYRAMIDS, 1970



Source of data: *U.N. Demographic Yearbook, 1972.*

PURPOSE: To examine the impact of the energy crisis on suburban life.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: I-4 In any environment, one component--like space, water, air, or food--may become a limiting factor.

PROBLEM: IV-1 Eco-Community Relationships - ecological considerations

REFERENCE: Energy, Key to the Future - Teaching Techniques for the Understanding and Conservation of Energy K-12. Dutchess County Board of Cooperative Educational Services, RD #1 Salt Point Turnpike, Poughkeepsie, New York 12601.

ACTIVITY: The suburban sprawl surrounding all large cities in the U.S.A. is based on the use of the privately owned automobile, and man's ability to live away from his work.

What are the suburban communities in your county? What is their future? Will suburban sprawl stop as a result of the energy crisis?

Organize within the class small teams to investigate questions such as the above. Assign to each team the responsibility to collect information or opinions from designated suburban communities by contacting appropriate municipal officials and/or by interviews with other persons living in the various suburbs. Do they see suburban life threatened by the energy crisis? What do they suggest be done to minimize the problem?

Share team findings in a class discussion and attempt to find consensus.

PURPOSE: To examine industrial and governmental responsibilities on environmental matters.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: III-3 Environmental management involves the application of knowledge from many different disciplines.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Living Within Our means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Many Americans have begun to question the practices of government and industry insofar as these practices threaten dwindling resources and intrude upon elements of the environment with which people are interdependent (water supply, food chains, public lands). The question that arises is one of how can these objections, or at least reservations, of individuals be best expressed collectively in the democratic political system. Further, how may these concerns be reflected in the modified private enterprise market economy which characterizes our way of life? Have the class examine the procedure of a large industry whose resource use, manufacturing, or marketing operations have some adverse effect upon the environment.

How does the corporate structure permit stockholders to exercise judgement over these actions?

Do their reasons for being stockholders create conflict of interest between corporate objectives and environmental objectives?

How many interested citizens, other than stockholders, hold the corporation liable for its actions?

When do private interests abuse public interests?

How can the judicial system aid the "environmentally concerned" citizen?

What role and responsibility does the government have in this matter?

Does the weight and influence of an organized lobby group frequently work against the common good? Explain.

As population grows and governmental operations increase correspondingly, do the people lose some of their ability to influence governmental actions? Explain. What, if anything, can be done to make government more responsive?

PURPOSE: To examine the increasing inter-dependency of people and "the right to strike."

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: IV-2 The rate of change in an environment may exceed the rate of organism adaptation.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

ACTIVITY: With imput from the class develop on the chalkboard a list of examples that illustrate how people are becoming more dependent on the services of other people than they were a few generations ago. Food is produced on specialized farms, processed by union labor, and delivered to stores by members of the Teamsters Union. Few people today in the U.S.A. grow and process much of their own food supply. Most people in America are very dependent on others for food, clothing, shelter, transportation, communication, entertainment, and other things we use so freely.

In a highly inter-dependent society one small tightly organized group such as Teamsters, garbage collectors, policemen, firemen, and many others can jeopardize the welfare of almost everyone in a large city. Can/should society tolerate such a condition? On the basis of recent trends is this problem likely to grow or diminish? What choices are available to society? What choices have been made by some other countries? What has been gained or lost as a result of these choices? After some "off-the-cuff" student reaction to such questions ask for volunteers to agree to research and debate the pros and cons of the "right to strike." Ask the debaters to consider whether there should be a distinction between the rights of workers in private industry and those working in government jobs. Why or why not?

PURPOSE: To examine changing attitudes regarding the threat posed to the world by the development and proliferation of nuclear weapons.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: IV-2 The rate of change in an environment may exceed the rate of organism adaptation.

PROBLEM: III-1 Genetic Considerations - radioactivity

ACTIVITY: Review with the class the feeling of revulsion felt by many people throughout the world when the U.S.A. destroyed two Japanese cities with atomic bombs near the end of World War II. Review the concern expressed by many people when the U.S.A. developed the hydrogen bomb which was many times more powerful. Review also the concern expressed by many people, primarily in the U.S.A., when the U.S.S.R. developed fission and subsequently fusion nuclear weapons.

Presently six countries have exploded nuclear devices and several other countries have the potential for doing so quickly. Yet today we find less said and written about the dangers of nuclear warfare than was the case 25 years ago. Why? How has mankind learned to live with less worry despite an enormously larger number of nuclear weapons? Do we have assurance that the potential for mutual self-destruction is so large and so well understood that no country will ever use such weapons? Have the traditional causes of war been reduced or eliminated? Should small countries be permitted to develop or buy nuclear weapons? Why or why not? What alternatives are possible? What must be changed to implement suggested alternatives?

PURPOSE: To review the importance of cereals in the world's food supply.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: I-2 Green plants are the ultimate sources of food, clothing, shelter, and energy in most societies.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: Interchange* - Population Education Newsletter Vol. 3 No. 4.

ACTIVITY: Review with the class the fact that grains are the main source of both calories and protein for a majority of the world's people. About 400 pounds of grain per year are available to the average person in the developing countries. Contrast this with the fact that the average American consumes about 2,000 pounds of grain per year but only 150 pounds are consumed as cereal foods -- the remaining 1850 pounds are used to produce eggs, chicken, beef, pork and other animal protein foods. Indicate also that animals may be fed 10-20 pounds of cereal protein foods to produce one pound of animal protein. Ask students to speculate why the average amount of beef and chicken consumed by each American increased by 111 and 204 percent respectively while consumption of wheat (flour) dropped by 30 percent between 1940-72.

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*Interchange is a publication of the Population Reference Bureau, Inc. edited by Judith Seltzer. It is distributed to teachers, curriculum supervisors, administrators, as well as to other centers of potential population education activity. The purpose of this newsletter is to provide information on the most recent developments in the growing effort to introduce population issues into formal school curricula, primarily at the middle and secondary school levels. Interchange is dependent upon information and ideas from its readers to facilitate two-way communication; the Editor openly solicits such an exchange. Annual Interchange subscription is $2.00. Membership in PRB reduces the rate to $1.00.

The Population Reference Bureau, Inc., 1755 Massachusetts Avenue, N.W., Washington, D.C. 20036 is a non-profit educational organization established in 1929. Through its bi-monthly issues of Population Bulletins, the annual World Population Data Sheet and other publications, the Bureau is a source of information on the facts and implications of national and world population trends.

Present to the class the following data regarding population, food, and agricultural land in the world.

PERCENT OF WORLD POPULATION, FOOD, AND AGRICULTURAL LAND BY REGION

Region	Population[1]	Food[2]	Agricultural Land[3]
Africa	10	5	40
Asia	57	26	30
Europe	12	17	50
Latin America	8	5	30
North America	6	21	25
Oceania	1	1	60
USSR	6	25	30
	100	100	

[1]1973 World Population Data Sheet.
[2]Based on cereal production, FAO Production Yearbook, 1970.
[3]Agricultural land includes arable land, land under permanent cultivation and permanent meadows and pastures. Agricultural land is given as percent of total land area in each region. FAO Production Yearbook, 1970.

Indicate that the current and future food crisis throughout the world is related to many factors such as farming techniques, Green Revolution, cost and availability of energy and fertilizer, land reform, transportation and marketing of food, population change, consumption patterns, World Food Bank, and national agricultural policies. Divide the class into small teams to collect clippings and articles on these aspects and contribute their findings in a class discussion of the world's food problems as found in some or all of the regions cited. Make certain the class considers future alternatives such as mass starvation, food aid programs, and altering consumption patterns.

PURPOSE: To examine the potential contribution of youth in developing and maintaining natural resources.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

ACTIVITY: Present to the class information about the recently funded federal program to help support Youth Conservation Corps programs in the various states. Indicate that the four-week summer programs presently limited to fewer than 400 high school students (age 15-18) in a state as populous as Ohio are intended to (1) provide gainful employment in an outdoor environment, (2) increase awareness, understanding, and appreciation of the state's environmental and cultural heritage, and (3) further the development and maintenance of some of the state's natural resources.

Review with the class the types of useful outdoor work such as building trails, planting trees, developing campgrounds, checking erosion, beautifying highways, improving playgrounds, and many other things that could be accomplished by energetic youth. Review also the value, if any, of living in a Conservation Camp away from home with 50-100 other young people from widely scattered places and possibly with some different beliefs while participating in the work, recreation, and discussion group activities offered in a good camp program.

Since this idea appeals to many youth and would appear to offer good promise for economic return to future generations ask the class to speculate as to why it has been so slow in coming and why it is still a very small program?

Would any of them be interested? Should such programs be supported by national and/or state governments? By other groups? Can federal funding for such a program be defended when we already have huge federal deficits?

If youth really wants to participate in such a program what can they do to increase their opportunities? What do their congressman and senators think of such a program? Would they be amenable to pressure from youth? Who would oppose such a program? How could youth try to change the opinion of those who oppose?

PURPOSE: To consider advantages and disadvantages of rail and truck transportation.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

ACTIVITY: At an appropriate place during a study of transportation review the historical importance of railroads in the economic development of the United States. Point out to the class that in the past thirty years a tremendous amount of freight, formerly moved by rail, has been shifted to trucks. Why has this happened? What advantages and disadvantages are associated with this shift?

Ask three students to volunteer to review such questions with representatives of the railroad industry and another three students to do the same with representatives of the trucking industry. Urge the students to interview several persons who represent different aspects of an industry such as trucking company owner, truck driver, and large consumers such as warehouse manager. Try to interview at least some persons who are old enough to have lived through the movement from rail to truck traffic.

Ask the two groups of students to report their findings to the class. Identify areas of agreement or disagreement within the railroad and trucking industries. Ask the entire class to consider the possibility that we, as a country, may have moved too much traffic from rail to highway. If so, what can be done about it?

PURPOSE: To examine problems associated with modifying the transportation system in the U.S.A.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

ACTIVITY: Review with the class the well-known prominence of the private automobile and the commercial truck in our transportation system. Indicate the inefficiency, in terms of energy usage, of private automobiles when compared with mass transit systems. Do the same comparing freight trains with trucks.

Increasing energy costs added to the increasing traffic congestion in big cities have caused political leaders such as President Ford to request that about one-fourth of "highway trust funds" (obtained from federal tax on gasoline) be diverted from enlarging our superhighway system. Instead, this portion of the funds would be used to improve mass transit systems including railroads. This proposal is opposed vehemently by the so called highway lobby.

Engage the class in identifying prominent elements in this lobbying group. Who would oppose the proposed diversion of some of highway construction funds? Why?

Devise with the class a simple questionnaire to ascertain how various groups feel about the President's proposal. Ask each student to interview two or three persons to see if they agree or disagree with the proposal. Make certain that persons representing special interests such as mass transit companies, trucking companies, highway construction workers, truck manufacturers, road machinery companies, as well as the lay public,are contacted.

Discuss the data obtained and attempt to determine the amount of consensus or disagreement. Finally ask the class to "vote" for or against the President's proposal.

PURPOSE: To become sensitive to the nature of conflicts over environmental issues and the threats posed to traditional rights and privileges.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: V-3 Psychological and Behavioral Consideration - cultural considerations

REFERENCE: "How Will We React to an Age of Scarcity"? Conservation Foundation Letter (a copyrighted publication) January 1975.

ACTIVITY: Review with the class examples of conflict over environmental issues that involve different social groups such as the following quoted, with permission, from the reference cited above:

1. *Individual vs. individual.* One man wants his property rezoned to allow development; his neighbor wants to protect his environmental advantages. Everyone wants to have wastes dumped, or an oil refinery located, in someone else's state or community.

   A man living on a fixed income wants to see government brake inflation; another, laid off from his job, wants an antidote to recession. "Inflation makes spending decisions for us that we once were free to make ourselves," says Issue No. 3 of Skeptic. "Inflation has narrowed our choices and options. In the end, it threatens to eliminate them entirely." But the man out of a job is similarly without options.

   The dilemma was put another way by Maurice Barbash in a letter to the editor of the New York Times last October 4: "A limitation on growth as our society is currently structured would impose a crushing sentence on the presently disadvantaged. We still operate under the terms of a 'trickle down' philosophy, where the poor get a little something only when the rich get richer."

2. *Individual vs. community.* A builder and a would-be homeowner are stymied by a community-imposed sewer moratorium. Or the government insists on purchase of an automobile pollution control device to safeguard the community's air resource.

3. *Individual, or community, vs. corporation.* The public wants a company to stop polluting a stream; but the company is anxious to avoid the high cost. To put it another way, a corporate activity that benefits stockholders and company managers may be in conflict with the interests of residents, workers or consumers, or a government acting in their behalf, or vice versa.

4. *Corporation vs. corporation.* With shortages of oil and natural gas, companies clash over their allocations. The same goes for places in the West where water is in limited supply.

5. *Nation vs. Nation.* Export controls and other trade barriers are obvious examples of friction between developed and less developed countries. These are unlikely to diminish with greater scarcity and greater conflict between environmental and development goals. "Mankind has still found no organized system for reconciling the driving demands and ambitions of national statehood with the wider unities of a shared planet," wrote Barbara Ward and Rene Dubos.

   Richard H. Gardner, law professor at Columbia University and a former State Department official, has suggested a "mutual survival pact," with developed nations agreeing to conserve energy, food and other resources, and to provide needed access to markets, technology and capital, while undeveloped countries agree to change some of their "suicidal" population, food and environmental practices.

6. *Present vs. future generations.* To what extent shall today's population husband its natural resources in the interests of tomorrow's, which has no say in the decisions? Heilbroner suggests that if we can acquiesce in the destruction of those contemporaries who rot in prison or starve to death, we are not likely to take the "painful actions" needed to protect future generations.

   "Worse yet," he says, "will (men) not curse these future generations whose claims to life can be honored only by sacrificing present enjoyments; and will (men) not, if it comes to a choice, condemn them to nonexistence by choosing the present over the future?

Review, also, a list of rights such as the following quoted from the same publication:

1. *Civil liberties.* Under this heading are the various political rights which are so essential to democracy- the rights of free speech, assembly, due process of law, privacy and security. One might add the right to play a role in political decision-making, not just by voting but through direct participation in open government.

2. *Human rights.* The right to have enough to eat; the right to health and safety through sufficient protection from unsafe drinking water, polluted air, radioactivity, and hazardous chemicals in consumer products and in the work-place; and the right to reasonable space and quiet.

3. *Social rights.* Some of these might also be considered privileges or amenities. But the category could include the right to procreate; the right to have a job; the right to travel freely (to foreign lands? in a big car without expensive pollution controls? for unlimited mileage?); the right to own one's own home (a detached dwelling? with plenty of yard space? a second home too?); the right to have access to an aesthetic environment, open space and recreation opportunities.

4. *Economic freedoms or privileges.* For the individual, there is the right to earn a decent living, or the right to a guaranteed minimum income; the right to one's material wants, what Heilbroner calls the "freedom of acquisition."

   For corporations there is the right to earn a profit; to use, and possibly pollute, common air, water or land resources; to be free of price controls, export controls, burdensome taxes and other governmental interference with the market-place; to withhold certain information from the public and the government; to obtain government subsidies; and to protect property from unfair confiscation.

5. *National rights.* A nation can be seen as entitled to freedom from unreasonable political, economic or environmental aggression by other nations.

Involve the class in identifying several conflicts over environmental issues currently under review or being debated in their community. Divide the class into small groups or assign to individuals the task of analyzing and explaining the nature of the conflict and the liberties, rights, or privileges under threat.

Ask, also, that each group or individual reporting indicate how they believe the conflict should be settled or compromised. When values are in conflict whose should prevail? Why?

PURPOSE: To become more sensitive to the concerns of "developing" nations.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: IV-5 Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

PROBLEM: IV-12 Eco-Community Relationships - effects of humans on ecosystems

REFERENCE: "Mini-Lessons on Environmental Awareness," Union County Schools, Lake Butler, Florida.

ACTIVITY: Divide the class into groups of four to six students. Each student is a member of a delegation to the United Nations representing the United States or some other industrially developed country such as USSR, Japan, West Germany, France, or Great Britain.

Each delegation receives a letter from a Latin American country making points in response to U.S. desires for international controls on the environment. The delegations are to study the letter and prepare a response in the form of a speech to be given when the issue is debated at the United Nations.

Below is a suggested "scenario" as prepared by a writing team of the Union County Florida school system:

Scenario

The year is 1985. You are a delegate to the United Nations representing the United States. Your immediate problem has to do with the pollution of the Pacific Ocean by a Latin American Country.

Here is how it all started: A number of Latin American countries are rapidly becoming industrialized. But they have had to pay a price for economic development--crowded cities, air and water pollution, and the whole range of modern problems with which Americans are familiar. One country in particular has stimulated international concern because a key industry is dumping pollutants into the Pacific Ocean and these have had a devastating effect on the fishing industries of other nations. Some ecologists have warned that the very existence of marine life in the Pacific is threatened.

You have suggested international controls to prevent such disregard for the environment, and Washington has even warned the country involved that all economic ties will be broken unless continued pollution is stopped. You have just received a reply from the Latin American delegate which makes the following points:

1. The industry in question cannot survive without producing pollutants. Ruining the atmosphere and the waterways has never prevented American industry from growing.

2. The United States has taken its usual high-handed position. Pollution created by the United States is totally disregarded and everyone knows that American industry does far more damage than all the developing nations put together.

3. The proposed actions discriminate against a nation which is struggling to achieve a better standard of living for its people. Simply because the U.S. has achieved prosperity does not give it license to keep other nations poor.

4. The U.S. and other industrialized countries have progressed by exploiting the Third World. Now the Third World wants to modernize. If the only technology available is a "dirty" one, then a dirty technology will be used. The best thing the U.S. could do would be to develop clean technology for Americans and all other peoples.

Your task is to prepare a reply, answering these largely moral questions by the Latin American country.

PURPOSE: To consider alternatives to future growth in metropolitan areas.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: II-1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and life-ways that are transmitted to its progeny.

PROBLEM: IV-5 Eco-Community Relationships - urban planning

REFERENCE: Options: A Study Guide to Population and the American Future. Population Reference Bureau, Inc., 1973.

ACTIVITY: Even assuming growth at the 2-child rate, the metropolitan population would grow by nearly 40 million people between 1970 and the year 2000, through natural increase alone (excess of births over deaths).

Where will these people live? By the year 2000, more than six of every ten Americans are expected to live in a metropolitan area of 1 million or more people. By that time, there will be 44 to 50 such places.

Several alternative distribution patterns of future U.S. population can be suggested. Ask students to propose policies whereby urban population could be redistributed. At least the following four alternatives should be included:

1. Back to the Country
2. Small Cities (10,000-50,000)
3. Secondary Growth Centers (50,000-250,000)
4. New Towns

Each student should select one alternative pattern for investigation. After students are grouped for discussion of their proposed alternative, ask each group to prepare a five-minute presentation on the feasibility of each redistribution pattern. Ask each group to deal with questions such as the following regarding their proposed alternative.

1. Back to the Country
   - How can a reverse trend back to the country be stimulated?
   - What role would rapid travel, radio, teletype, and closed circuit television play?
   - Are our communications and data transfer systems developed sufficiently to handle a widely dispersed working force?

- What are the economic advantages of city-centered industry?
- Could industry be dispersed to the countryside?

2. Small Cities
   - How could small cities be connected to major markets?
   - What social problems are likely to be less severe in small cities than in heavily urbanized areas?
   - Do our small cities have the capacity to absorb 10 to 25 percent of the 40 million expected increase by the year 2000?

3. Secondary Growth Centers
   - What methods could be used to attract more of the population to these cities?
   - What programs could be initiated to prevent the problems existing in the three megalopolitan areas from developing in the secondary growth centers?

4. New Towns
   - What is the social appeal of planned communities?
   - Where does the money come from to build and maintain them?
   - Should these new towns be required to meet criteria of balanced land use, income distribution and racial integration?
   - On what basis should the location of new towns be decided?

PURPOSE: To develop the realization that man is rapidly using up the non-renewable resources found on earth.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: IV-3 Eco-Community Relationships - natural resource use

REFERENCE: Human Implication of a Threatened Environment. Center for Environmental Education, 705 Avocado Avenue, Cocoa, Florida.

ACTIVITY: The table below lists some of the irreplaceable natural resources which are vital to modern industry. The United States has 6 percent of the world's people and uses between 40 and 50 percent of the world's irreplaceable natural resources. However, these facts do not become significant or impressive as long as we have an infinite supply of those resources. The questions which we must consider are: Do we have a limited supply of these irreplaceable resources? If so, what are our expectations for the future? The following table does not provide an answer to either of these questions, but it is an aid in understanding the existing situation. Please keep in mind all of the variables which are not taken into account such as presently undiscovered reserves, ore which is presently considered marginal, recycling, etc.

Resource	Static Reserve Index In Years	Exponential Reserve Index In Years At 2.5% Increase	Current Rate of Increase (%)
Aluminum	175	67	8.0
Chromium	560	108	4.0
Cobalt	155	63	4.6
Copper	40	28	3.3
Gold	17	14	2.4
Iron	400	98	3.8
Lead	15	13	2.0
Manganese	180	68	4.5
Mercury	13	13	3.0
Molybdenum	100	51	5.0
Nickel	140	60	8.7
Platinum	20	17	8.5
Silver	20	17	6.0
Tin	25	19	6.0
Tungsten	40	28	5.0
Zinc	18	15	6.2
Coal	900	127	3.6
Natural gas	35	25	6.6
Petroleum	70	41	6.9
Uranium	66	40	6.0

STATIC RESERVE INDEX given the number of years our known world reserves of that resource will last if we continue consuming it at the same rate we do today.

EXPONENTIAL RESERVE INDEX shows how long the reserves will last if the usage rate increases by 2.5 percent per year.

CURRENT RATE OF INCREASE shows, for comparison, what the ACTUAL growth rate in world consumption for each resource is today.

In considering the table have the students list these resources which are being used at the fastest rate. What are some ways in which these materials are being used? Can recycling play a role in reducing the loss of these resources? Invite a speaker from a local recycling center to discuss with the class some of the problems involved in processing material and reselling it.

PURPOSE: To examine issues related to land use.

LEVEL: 10-12

SUBJECT: Social Studies
Science

CONCEPT: III-4 Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

PROBLEM: IV-2 Eco-Community Relationships - land use

REFERENCE: "Land Pollution Reporter" July/August 1974.

ACTIVITY: Present to the class the following quotation from the reference cited above.

> Some areas of Houston, Texas are sinking at a rate of six inches per year, according to the U.S. Geological Survey. The sinking is caused primarily by the heavy use of groundwaters by chemical industries in the area and threatens an estimated $1 billion worth of property with potential flooding from Galveston Bay.

Engage the class in discussing the physical, economic, and social factors that lead to such a situation. Who should/must assume responsibility? What might be done to control the problem? Are the student suggestions feasible? Why or why not?

After reaching tentative conclusions in the class group ask each class member to interview three adults from different socio-economic groups or vocations to determine how they regard the problem cited above and to get their suggestions for controlling the problem.

Discuss the extent of agreement between the student and adult responses. Try to account for differences that might appear.

PURPOSE: To understand relationships between recreational activities and conservation principles.

LEVEL: 10-12

SUBJECT: Physical Education

CONCEPT: III-1 The management of natural resources to meet the needs of successive generations demands long-range planning.

PROBLEM: I-11 Aesthetic Considerations - recreational facilities

REFERENCE: "Conservation Taught in Physical Education" Rod McNab in Managing Minnesota's Environment (a Newsletter for Teachers) Agricultural Extension Service, University of Minnesota, Number 4, November 1974.

ACTIVITY: In a geographical area where fishing is available as an adult recreational activity a teacher of physical education could offer an elective coeducational physical education unit drawing on McNab's unit outline (reproduced next page) entitled "Angling - Know Your Fish." Special note should be made of the types of resource personnel available in most localities to assist the physical education instructor if help is desired.

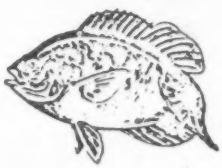
Conservation Taught in Physical Education?

Rod McNab, Lake Crystal High School

Is it unusual to teach ecological and conservation awareness in physical education classes? Perhaps, but in our high school it seemed the natural way to help prepare the future environmentalists to be activists in the out-of-doors today. A major goal in our senior high physical education department is to develop interests, knowledge, and skills in individual and group sports that students can take with them into adulthood. Minnesota's environment will be their future recreation centers.

Lake Crystal is bounded by three lakes; the Watonwan, Minnesota and Blue Earth Rivers; and acres of wooded river valleys. Doesn't it seem logical that we would include canoeing, cross-country skiing, down-hill skiing, shooting, and angling in our physical education program? Conservation of the natural environment is vital to continuing these recreational sports.

Minnesota's marine life, often in question in recent years, is a unit in our school. Teachers often can adapt outline units to specific classes and schools quite readily. The following is, in brief, my "Angling–Know Your Fish" unit as I teach it to a coeducational physical education class.



ANGLING–KNOW YOUR FISH

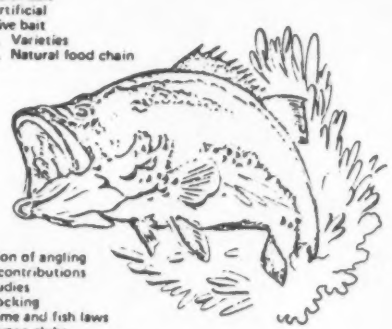
P. E. Unit

Objectives:

1. To learn the skill of angling as a lifetime recreational activity.
2. To add knowledge to the science of angling.
3. Appreciation of the natural resources of marine life.
4. To enable students to identify Minnesota's native fish.
5. To learn how the habitat of the fish now affects future angling.
6. To interest young people in the preservation of Minnesota's game fish.
7. To add awareness of DNR responsibilities.
8. To create interest in becoming personally involved in preservation of natural resources.

I. Angling–the sport
- A. Equipment (selection and care)
  1. Spinning
  2. Bait casting
  3. Fly casting
  4. Depth finder
  5. Thermometers
- B. Skills
  1. Preparing rod and reel for fishing
  2. Target casting
  3. Baiting
  4. Contour map reading and construction
  5. Knot tying
  6. Fish identification

II. Angling–the science
- A. Fish identification (Why each classification)
  1. Game fish
  2. Rough fish
  3. Bait fish
  4. Local species
- B. Habitat–positive and negative
  1. Spawning area
  2. Food producing areas
  3. Bottom types
     a. Rocky points
     b. Sand bars
     c. Weed beds
  4. Depth of water (Contour map study)
- C. Fish population
  1. Problems of overpopulation
     a. Lack of food
     b. Stunting of growth
  2. Problems caused by rough fish
     a. Destruction of habitat and spawning areas
     b. Food necessary for game fish is gone
  3. Population controls
     a. Gill nets
     b. Shallow water nets
     c. Fin clipping
- D. Environmental problems of fish
  1. Water temperatures
  2. Thermoclines
  3. Causes of freeze outs
  4. Oxygen content
  5. Pollution of water
- E. Types of bait
  1. Artificial
  2. Live bait
     a. Varieties
     b. Natural food chain



III. Preservation of angling
- A. DNR contributions
  1. Studies
  2. Stocking
  3. Game and fish laws
- B. Sportsman clubs
  1. Removal of rough species
  2. Removal of polluting factors
- C. Licenses
- D. Excise tax of fishing–hunting equipment

IV. Resource personnel
- A. Local fishermen
- B. Conservation officers from DNR
- C. Johnson Reel, Inc. representatives
- D. Personal knowledge and experiences of instructor

V. Materials available
- A. DNR materials
  1. Contour maps
  2. Slides for identification
  3. Game laws
  4. Pamphlets
     a. Minnesota fish quiz
     b. Others
  5. Films
- B. Pamphlet–How to Catch Fish
  by Fisherman's Information Bureau
  20 No. Wacker Drive
  Chicago, Illinois 60606
- C. Equipment usage (rods and reels)
  1. Rod and reel manufacturing companies
  2. Sporting goods stores
  3. Private donations
- D. Movies
  1. Way of a Trout by Johnson Reel
  2. Virgil Ward series on angling

This unit can be worked successfully with other high school departments such as biology. Both boys and girls wanted to continue the study. Awareness about conservation hopefully will make the students appreciate and support present efforts and contribute to future efforts to preserve this natural resource.

PURPOSE: To use free poetry to picture, as well as verbalize, the environment.

LEVEL: 7-9
10-12

SUBJECT: Language Arts

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: I-3 Aesthetic Considerations - visual pollution

REFERENCE: Environmental Education Guide - Language Arts 7-8. Project I-C-E, 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Poetry may not only describe scenes in words, but in the shape of the words as well. Poems may be diamond-shape (diamante) or shaped like the object being described. One suggestion is to write the poem on top of a picture or sketch of the scene being described. By strategically placing the words on the picture, the readers' attention can be drawn to certain points.

Have the class visit a site or view a scene where pollution of the environment is evident. Let the students express their feelings about the scene in free poetry.

An example, taken from Street Poems by Robert Froman (McCall Publishing Co.), is:

O F F A N D A W A Y

Little piece of paper on the ground.

Going nowhere.

Doing nothing.

Flat.

Little puff of wind.

PURPOSE: To think seriously about man and his environmental responsibilities.

LEVEL: 10-12

SUBJECT: Language Arts

CONCEPT: II-3 Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

PROBLEM: V-3 Psychological and Behavioral Considerations - cultural considerations

REFERENCE: Living Within Our Means: Energy and Scarcity. Environmental Education Instructional Activities K-6, The University of the State of New York, 1974.

ACTIVITY: Ask students to select a quotation such as those listed below as a theme for a composition. Encourage students to attempt figurative comparisons by using analogies and implementations in their comparisons. Urge students to include in their writing: time and place, description of existing conditions, the authors' perceptions and values, and analogies of specific environmental conditions existing today.

-"Value determines what we ought to do, not what one necessarily desires to do."

Dorothy Rethlingshafer

-"Man is the only animal that laughs and weeps, for he is the only animal that is struck with the difference between what things are and what things ought to be."

William Hazlitt

-"There is nothing man cannot make natural; there is nothing he cannot lose."

Blaise Pascal

-We used to be individuals, not populations. Perhaps we are now preparing for the great slaughter. No reason to be alarmed; stone dead is dead; breeding like rabbits we hasten to meet the day."

Robinson Jeffers

-"Behold the turtle; he makes progress only when he sticks his neck out."

James B. Conant

-"For as long as man has dwelt upon this earth, spring has been the season of rebirth and the singing of the birds. Now in some parts of America spring has been strangely silent, for many of the birds are dead."

Rachel Carson

-"We travel together, passengers on a little spaceship, dependent on its vulnerable reserves of air and soil; all committed for our safety to its security and peace; preserved from annihilation only by the care, the work, and the love we give our fragile craft."

Adlai Stevenson

PURPOSE: To stimulate concern for the environment through the arts.

LEVEL: 7-9
10-12

SUBJECT: Fine Arts

CONCEPT: II-2 The relationships between man and the natural environment are mediated by his culture.

PROBLEM: I-10 Aesthetic Considerations - cultural opportunity

REFERENCE: "Man vs. Nature - An Environment Study." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: An art class or a group of interested students could sponsor an environmental arts and crafts show. As a part of the show arts and crafts could be displayed, demonstrations given on making environmental crafts, and mini-lessons taught on art and the environment. Some areas to include may be:

1. Creative Writing
   Student works comparing natural and man-made objects.
   Study of Thoreau's Walden Pond. Similar student works.
   Poetic forms and styles (sometimes the poem takes the shape of the object being described.)

2. Sensory Awareness
   Using senses, other than just sight, to identify and appreciate man-made and natural materials; for example: a "Smell the Earth" exhibit.

3. Photographic Studies
   Displays of photographic art.
   Essay pictures similar to the book The Family of Man.
   Slide/tape presentations.
   Double exposure displays showing opposites in natural and man-made objects, in human experiences, in social phenomena.

4. Arts and Crafts
   Crafts from the natural world, e.g., dried flowers, pine cone art, root rubbings and plant dyes.
   Crafts from the man-made world, e.g., macrame, batik, candle-making.
   Environmental cooking.
   Dance - interpretation of impressions of nature, of man's world.
   Music - original musical instruments and demonstrations. Analysis of modern song about nature and man.

PURPOSE: To identify and illustrate student concerns about their environment.

LEVEL: 7-9
10-12

SUBJECT: Fine Arts

CONCEPT: IV-4 Man has been a factor affecting plant and animal succession and environmental processes.

PROBLEM: V-2 Psychological and Behavioral Considerations - social aspects

REFERENCE: Environmental Education Guide (Art 7-9) Project I-C-E, (Instruction-Curriculum-Environment) 1927 Main Street, Green Bay, Wisconsin 54301.

ACTIVITY: Present to the class the following major environmental concept (one of twelve) found in the reference cited above:

> Factors such as facilitating transportation, economic conditions, population growth, and increased leisure influence changes in land use and population densities.

Engage the class in verbalizing some of their impressions concerning how land use and/or population density has been affected by these factors. Urge them to draw on their knowledge of earlier, simpler, cultures as well as their knowledge of the present fast-changing world.

Suggest that environmental problems or concerns might be presented more forcefully by a well designed and created poster or collage than by mere words. Ask students, working alone or in pairs, to create posters that will communicate forcefully some of their concerns about their environment.

After the posters are completed discuss their effectiveness in the class and select some of the better ones for display in the school or in a store, bank, or other building.